GATE 2017 Question Paper (Life Sciences - XL)

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Chemistry (XL-P)

1) CO reacts readily with (GATE XL 2017)

a) Fe b) Fe^{2+} c) Fe^{3+} d) Fe^{4+}

2) Molecules that are NOT isoelectronic to NO^+ ion are (GATE XL 2017)

a) CO^+ and N_2
b) NCO and H_3BCN
c) BO_2^- and $H_3C–C\equiv CH$
d) OF_2 and O_3^+

3) The extensive quantity among the following is (GATE XL 2017)

a) Pressure
b) Temperature
c) Chemical potential
d) Volume

4) The compound that gives characteristic foul smell upon heating with potassium hydroxide and chloroform is (GATE XL 2017)

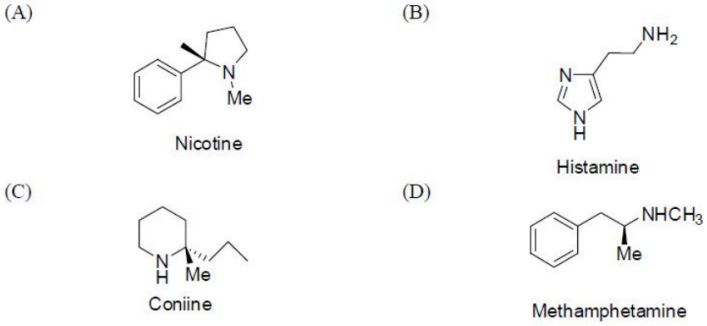

Fig. 1: Q4 options

5) The correct order of stability in water is (GATE XL 2017)

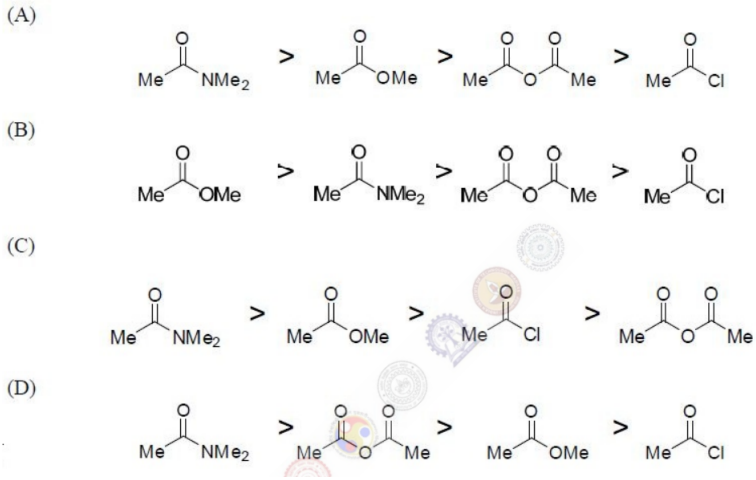

Fig. 2: Q5 options

6) The pair of molecules having non-linear structures is (GATE XL 2017)

a) ICl_3 and BeH_2 b) CS_2 and I_3^- c) SO_3 and ClO_2^- d) XeF_2 and CN^-

7) The decreasing order of bond lengths for O_2, B_2, N_2 and C_2 is (GATE XL 2017)

a) $B_2 > C_2 > N_2 > O_2$
b) $B_2 > C_2 > O_2 > N_2$
c) $N_2 > C_2 > O_2 > B_2$
d) $B_2 > O_2 > N_2 > C_2$

8) The octahedral metal oxide with the highest CFSE value is (GATE XL 2017)

a) ZnO b) MnO c) VO d) TiO

9) Assuming independent non-interacting electrons, the first ionization energy of Helium atom is (GATE XL 2017)

a) 13.6 eV b) 27.2 eV c) 54.4 eV d) 108.8 eV

10) For a reaction A + B $\longrightarrow$ products, the following data was obtained: $[A]_0$ and $[B]_0$ are initial concentrations of A and B, respectively. The overall order of the reaction is (GATE XL 2017)

a) 2 b) 3 c) 4 d) 5

11) The EMF for the following cell at 298.15 K is (GATE XL 2017)
Ag(s) | Ag^+(aq., 0.01 M) || Ag^+(aq., 1.0 M) | Ag(s)
(Standard reduction potential for $Ag^+ + e^- \rightarrow Ag$ is -0.80 V)

a) 0.12 V b) 0.68 V c) 0.80 V d) 0.92 V

12) One gram of a protein is dissolved in one liter of water. The resulting solution exerts an osmotic pressure of 1.4 Torr at 298 K. Assuming that the protein does not ionize in solution, the molecular weight of the protein is _____ g mol^{-1}. (R = 0.082 L atm mol^{-1} K^{-1}) (GATE XL 2017)

13) The type of nucleophilic substitution and the possible products for each of the reactions P and Q are (GATE XL 2017)

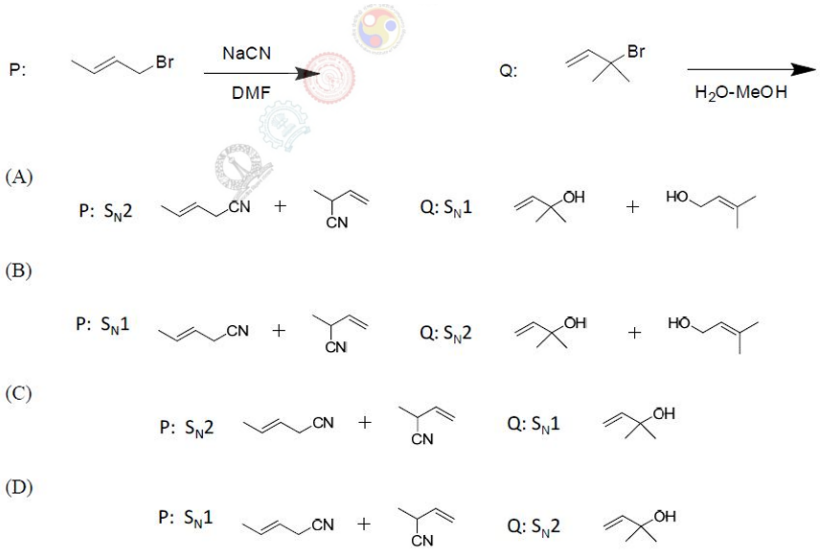

Fig. 3: Q13 options

14) If mono-chlorination occurs at every carbon in the following reaction, the number of isomers (stereo isomers + constitutional isomers) that one can have is (GATE XL 2017)

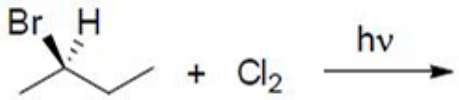

Fig. 4: Q14 options

a) 4 b) 5 c) 6 d) 8

15) The major product in the following reaction is (GATE XL 2017)

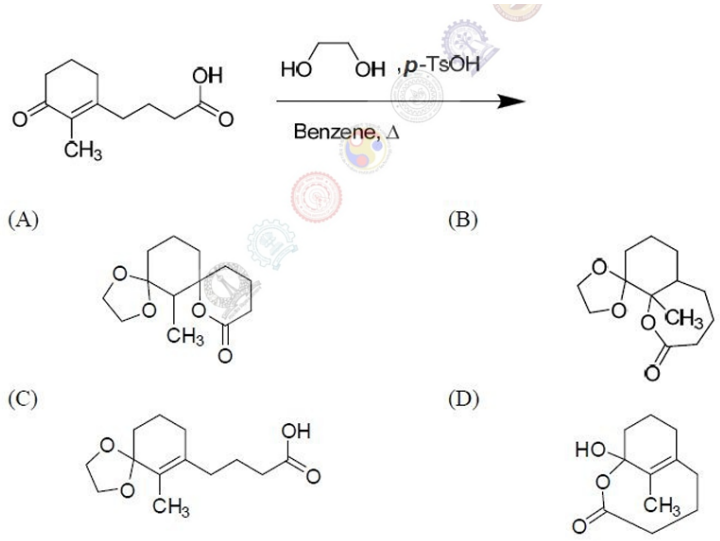

Fig. 5: Q15

Biochemistry (XL-Q)

16) The molecular weight of a protein as determined by native PAGE is 400 kDa. This protein when run on a non-reducing SDS-PAGE gave a band of 200 kDa, and on a reducing SDS-PAGE, gave a band of 100 kDa. The protein has (GATE XL 2017)
   a) Four subunits of which two sets are linked by two disulfide bridges
   b) Four subunits which are linked by four disulfide bridges
   c) Two subunits only and none are linked by disulfide bridges
   d) Two subunits which are linked by disulfide bridges

17) Which one of the following techniques CANNOT be used to determine the sequence of a novel protein? (GATE XL 2017)
   a) De novo sequencing by ESI-MS/MS
   b) Edman degradation
   c) Sanger sequencing
   d) Peptide mass fingerprinting

18) Which type of polyacrylamide gel can be used for analyzing the four different proteins listed below?
   Protein P: 60 kDa, pH 4
   Protein Q: 45 kDa, pH 8

Protein R: 60 kDa, pH 6
Protein S: 45 kDa, pH 7.5 (GATE XL 2017)

a) 20% gel, pH 4–7
b) 20% gel, pH 3–10
c) 12% gel, pH 3–10
d) 12% gel, pH 4–7

19) The number of fragments generated when the peptide 'ANDCQEGKFMLKPDTWRYVSFMRPA' is subjected to complete digestion with trypsin are _____ (GATE XL 2017)

20) Puromycin is a structural analog of (GATE XL 2017)

a) alanyl-tRNA b) tyrosyl-tRNA c) methionyl-tRNA d) glycyl-tRNA

21) Which one of the enzymes is responsible for arsenic toxicity? (GATE XL 2017)

a) Pyruvate kinase
b) Aldolase
c) Phosphofructokinase
d) Pyruvate dehydrogenase

22) Which one is TRUE for Calvin cycle? (GATE XL 2017)

a) Glycerol 3-phosphate is generated in this cycle
b) CO_2 is not consumed in this cycle
c) This is a reductive pentose phosphate cycle
d) Ribose 5-phosphate is a carboxylation substrate in this cycle

23) Administration of primaquine causes severe hemolytic anemia because it (GATE XL 2017)

a) Increases the demand for NADPH to a level that cells can't meet
b) Decreases the demand for NADPH
c) Inactivates glutathione peroxidase of erythrocytes
d) Increases reduced glutathione level of erythrocytes

24) Which one of the following will NOT form lipid bilayer? (GATE XL 2017)

a) Cholesterol
b) Phosphatidyl ethanolamine
c) Triacylglycerol
d) Phosphatidyl serine

25) Which one of the following features is NOT appropriate for Fab fragment of IgG? (GATE XL 2017)

a) Contains antigen binding site
b) Contains an intact L chain
c) Two fragments are formed from one IgG molecule
d) Mediates complement fixation in the intact IgG molecule

26) The duration of DNA synthesis (*S phase*) in plant cells is 11 h and the DNA is replicated at a rate of 100 bp/fork. A plant species has about 3.0×10^{10} bp/genome. The number of bidirectional forks per genome required for replication will be _____. (GATE XL 2017)

27) In a PCR reaction, with one double stranded DNA of 600 bp, nano gram of DNA produced after 40 cycles of amplification will be_____. (GATE XL 2017)

28) A solution containing GTP has molar extinction coefficient of 1.55×10^4 $mol^{-1}dm^3cm^{-1}$ at a given wavelength. The concentration of GTP solution is 1.290×10^{-5} mol dm^{-3}. The absorbance of GTP solution in 1 cm cuvette at the same wavelength will be _____. (GATE XL 2017)

29) Which one of the following is NOT TRUE for class I MHC protein?(GATE XL 2017)

a) MHC class I protein are polymorphic
b) T-cell receptors recognizes MHC class I protein
c) MHC class I protein are displayed on the surfaces of nucleated vertebrate cells
d) β_2-microglobulin is covalently associated with MHC class I protein

30) In an enzyme catalyzed reaction, the initial reaction velocity is only one fourth of its maximum velocity. If the substrate concentration is 3.0×10^{-3} mM, the value of K_m in micro molar (μM) will be _____ (GATE XL 2017)

31) Match the following enzymes in column I with their cofactors in column II: (GATE XL 2017)

Column I	Column II
P) Pyruvate decarboxylase	i. Biocytin
Q) Glyceraldehyde 3-phosphate dehydrogenase	ii. $NADP^+$
R) Pyruvate carboxylase	iii. NAD^+
S) Glucose-6-phosphate dehydrogenase	iv. Thiamine pyrophosphate

a) P-ii; Q-i; R-iv; S-iii
b) P-iv; Q-iii; R-i; S-ii
c) P-i; Q-ii; R-iii; S-iv
d) P-iii; Q-i; R-iv; S-ii

32) Match the molecule in column I with its function in column II: (GATE XL 2017)

Column I	Column II
P) Cholera toxin	i. modifies $G_{\alpha i}$
Q) Pertussis toxin	ii. inhibits c-AMP phosphodiesterase
R) IP_3	iii. modifies $G_{\alpha s}$
S) Caffeine	iv. increases intracellular Ca^{2+} level

a) P-iii; Q-i; R-iv; S-ii
b) P-iv; Q-i; R-iii; S-ii
c) P-ii; Q-iv; R-i; S-iii
d) P-iii; Q-i; R-ii; S-iv

33) In an in vitro dehydrogenation reaction of succinate catalyzed by succinate dehydrogenase, malonate is added. Which one of the following curves represents the effect of malonate on the catalysis of succinate dehydrogenase? (GATE XL 2017)

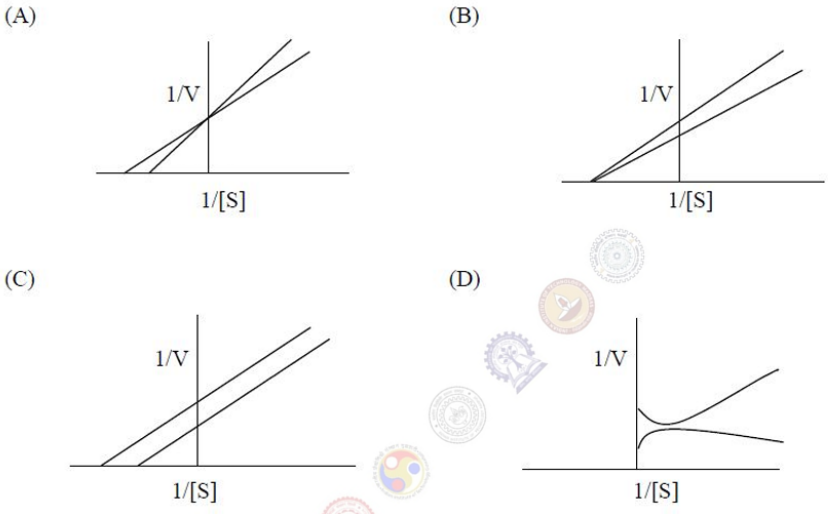

Fig. 6: Que. 33

34) Cardiotonic steroids have ability to strengthen heart muscle contraction due to the fact that these steroids (GATE XL 2017)

a) inhibit K^+-dependent dephosphorylation of Na^+-K^+ ATPase
b) activate Na^+-K^+ ATPase
c) increase uptake of Na^+ by activation of Na^+-Ca^{2+} exchanger
d) increase uptake of Ca^{2+} by activation of Na^+-Ca^{2+} exchanger

35) A newly isolated circular plasmid gave two bands of 3.2 and 3 kb on digestion with EcoRI and two bands of 5.0 kb and 1.2 kb on digestion with BamHI. Double digestion with EcoRI and BamHI, yielded four bands of 2.6 kb, 2.4 kb, 0.8 kb and 0.4 kb. Digestion with SalI led to disruption of ampicillin resistance gene cassette. The correct restriction map is (GATE XL 2017)

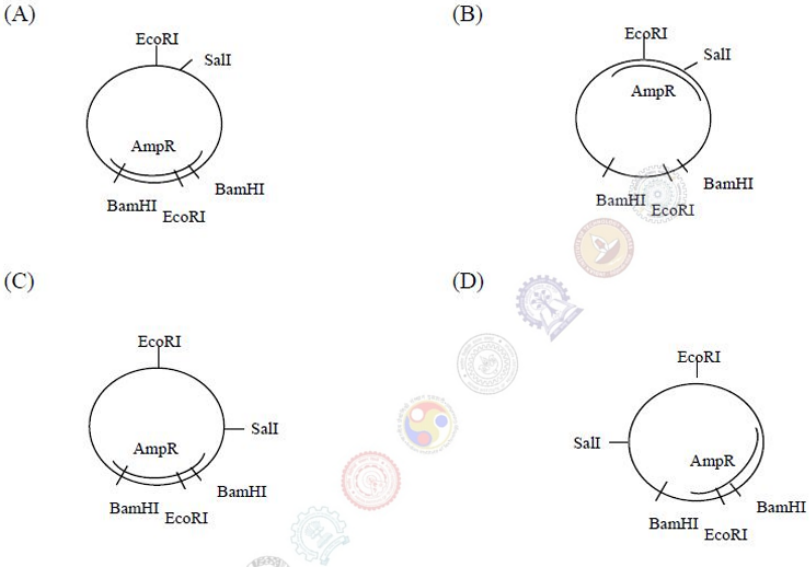

Fig. 7: Que. 35

Botany (XL-R)

36) As per the Angiosperm Phylogeny Group (*APGII*, 2003) classification, which of the following plant families comprises of only single genus with single species? (GATE XL 2017)

a) Lauraceae
b) Aristolochiaceae
c) Amborellaceae
d) Typhaceae

37) A cavity, lysigenous in origin and possessing volatile oil is found in the pericarp of one of the following plants. Identify the CORRECT answer. (GATE XL 2017)

a) Litchi
b) Citrus
c) Mango
d) Coconut

38) Among the following, which genetic material is naturally inherited through maternal inheritance in higher plants? (GATE XL 2017)

a) Nuclear DNA
b) Plasmid DNA
c) Chloroplast DNA
d) T-DNA

39) A typical floral meristem differs from shoot apical meristem on the basis of (GATE XL 2017)

a) Determinate growth
b) Presence of auxin
c) Presence of stem cells
d) Negative geotropism

40) Which of the following plant hormones is a carotenoid-cleavage product? (GATE XL 2017)

a) Phytosulfokine
b) Brassinosteroid
c) Methyl jasmonate
d) Strigolactone

41) Two of the *vir* operons of Ti plasmid in *Agrobacterium tumefaciens* are constitutively expressed. Identify the CORRECT pair. (GATE XL 2017)

a) *virA* and *virG*
b) *virF* and *virH*
c) *virC* and *virD*
d) *virB* and *virE*

42) Which of the following fungi is an example of obligate biotrophic plant pathogen? (GATE XL 2017)

a) *Alternaria brassicicola*
b) *Botrytis cinerea*
c) *Puccinia triticina*
d) *Sclerotinia sclerotiorum*

43) The phenomenon where an organism lives at the expense of another organism by harming it but not killing, is called (GATE XL 2017)

a) Commensalism b) Predation c) Symbiosis d) Parasitism

44) Which of the following is TRUE for *K*-strategist species? (GATE XL 2017)

a) Produce relatively large number of offspring
b) Population often grow exponentially
c) Provide relatively little or no parental care to offspring
d) Occur in stable and predictable habitats

45) Identify the INCORRECT statement with relation to plant secondary metabolites. (GATE XL 2017)

a) Atropine is a member of indole alkaloids
b) Limonene is a cyclic terpene found in citrus plants
c) Green tea is rich in polyphenols
d) Cyanidin contributes to the red color in rose petals

46) Choose the CORRECT set of matches between group I and group II in relation to nitrogen fixation and assimilation (GATE XL 2017)

Column I	Column II
P) Nitrobacter	i. $NO_3^- \rightarrow NO_2^-$
Q) Nitrite reductase	ii. $N_2 \rightarrow NH_3$
R) Nitrogenase	iii. $NO_2^- \rightarrow NH_4^+$
S) Nitrate reductase	iv. $NO_2^- \rightarrow NO_3^-$

a) P-4, Q-3, R-2, S-1
b) P-4, Q-3, R-1, S-2
c) P-1, Q-2, R-4, S-3
d) P-3, Q-4, R-2, S-1

47) Two plant cells M and N are lying side by side making direct contact. "M" has osmotic potential Ψ_s of -10 bar and pressure potential Ψ_p of 4 bar. On the other hand, "N" has osmotic potential Ψ_s of -12 bar and pressure potential Ψ_p of 5 bar. Based on these data, what would be the direction of movement of water between M and N? (GATE XL 2017)

a) M to N
b) N to M
c) There will be no movement
d) In both directions

48) Two independent non-segregating recessive mutants ($m1$ and $m2$) display similar defects in petal formation. When they were crossed with each other ($m1 \times m2$), all the F_1 plants developed normal petals. In view of this observation, which of the following conclusions is CORRECT? (GATE XL 2017)

a) Mutations in both $m1$ and $m2$ are in the same gene
b) Mutations in both $m1$ and $m2$ are in two separate genes
c) Inheritance is non-Mendelian
d) None of the above

49) In a hypothetical trihybrid cross of three loci (viz. A, B, C), all were inherited in a complete dominant manner over their recessive alleles a, b, c, respectively. When a test cross between F_1 and parent "*aabbcc*" was performed, following genotypes of eight phenotypically distinct classes were observed with respective numbers (GATE XL 2017)

Class	**Genotype**	**Number**
1	*ABC*	412
2	*abc*	406
3	*Abc*	85
4	*aBC*	80
5	*ABc*	08
6	*abC*	07
7	*AbC*	01
8	*aBc*	01

The genetic distance (up to one decimal) between A and C loci will be _____ cM.

50) In a typical sexually reproducing angiospermic plant, if an endosperm cell contains 4.8×10^8 nucleotide pairs of DNA, then a microsporocyte of this plant will have _____ $\times 10^8$ nucleotide pairs of DNA. (GATE XL 2017)

51) Identify the CORRECT matching between group I and group II in relation to ecology (GATE XL 2017)

Group I	**Group II**
P) The physical environment of an organism	1) Trophic level
Q) The totality of the needs of a population for survival and its resource utilization	2) Habitat
R) The position of a species in a food chain	3) Ecosystem
S) Basic functional unit comprising living community and its physical environment	4) Niche
	5) Ecological pyramid

a) P-2, Q-5, R-4, S-1
b) P-2, Q-4, R-1, S-3
c) P-5, Q-2, R-3, S-1
d) P-1, Q-3, R-4, S-2

52) Choose the CORRECT set of matches between group I and group II in relation to plant genetic transformation methods. (GATE XL 2017)

Group I	**Group II**
P) Helium	1) *Agrobacterium tumefaciens*
Q) Acetosyringone	2) Microinjection
R) Polyethylene glycol	3) Particle bombardment
S) Agarose embedding	4) Protoplast

a) P-4, Q-3, R-2, S-1
b) P-2, Q-1, R-4, S-3
c) P-3, Q-4, R-1, S-2
d) P-3, Q-1, R-4, S-2

53) Match the pathogen, disease caused and the affected plant in the CORRECT combination. (GATE XL 2017)

Pathogen	**Disease**	**Plant**
P) *Blumeria graminis*	i) Blast disease	1) Groundnut
Q) *Magnaporthe grisea*	ii) Powdery mildew	2) Apple
R) *Venturia inaequalis*	iii) Tikka disease	3) Barley
S) *Cercospora personata*	iv) Scab disease	4) Rice

a) P-i-1, Q-ii-2, R-iii-3, S-iv-4
b) P-i-2, Q-ii-1, R-iii-4, S-iv-3
c) P-i-3, Q-i-4, R-ii-2, S-iii-1
d) P-ii-3, Q-i-4, R-iii-2, S-iv-1

54) Choose the plant part, its use and the source species in **CORRECT** combination. (GATE XL 2017)

Plant Part	**Use**	**Species**
P) Bark	i) Insecticide	1) *Crocus sativus*
Q) Leaf	ii) Food colorant	2) *Papaver somniferum*
R) Capsule	iii) Flavoring agent	3) *Azadirachta indica*
S) Stigma	iv) Analgesic	4) *Cinnamomum zeylanicum*

a) P-i-1, Q-ii-2, R-iii-3, S-iv-4
b) P-iii-4, Q-ii-1, R-iv-2, S-i-3
c) P-ii-1, Q-i-3, R-iv-2, S-iii-4
d) P-iii-4, Q-i-3, R-iv-2, S-ii-1

55) Which **TWO** of the following reactions are **INCORRECT** in relation to C_2 oxidative photosynthetic carbon cycle in land plants? (GATE XL 2017)
P. 2 (Ribulose-1,5-biphosphate) + 2 (CO_2) → 2 (phosphoglycolate) + 2 (3-phosphoglycerate) + $4H^+$
Q. Serine + α-ketoglutarate → hydroxypruvate + glutamine
R. 2 (Phosphoglycolate) + 2 (H_2O) → 2 (glycolate) + 2Pi
S. Hydroxypyruvate + NADH + H^+ → glycerate + NAD^+

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

56) Which one of the following is the end product of dissimilatory sulfate reduction by sulfate reducing bacteria? (GATE XL 2017)

a) Hydrogen sulfide
b) Sulfur dioxide
c) Sulfur
d) Thiosulfate

57) Which one of the following is the terminal electron acceptor in the given metabolic reaction catalyzed by methanogens? (GATE XL 2017)

$$4H_2 + CO_2 \longrightarrow CH_4 + 2H_2O$$

a) H_2
b) CO_2
c) CH_4
d) H_2O

58) Microbes that have their optimal growth rate near 15°C but can still grow at 0°C to 20°C are known as (GATE XL 2017)

a) Mesophiles
b) Psychrotrophs
c) Psychrotolerant
d) Psychrophiles

59) Which one of the following is **NOT** a contribution by Robert Koch? (GATE XL 2017)
a) Identification of causative agent of anthrax.
b) Discovery of causative agent of tuberculosis.
c) Discovery of causative agent of leprosy.
d) Identification of causative agent of cholera.

60) Unicellular eukaryotic organisms belong to which one of the following kingdoms of classification? (GATE XL 2017)

a) Monera
b) Plantae
c) Protista
d) Animalia

61) Which one of the following is a contagious disease? (GATE XL 2017)

a) Chickenpox
b) Tetanus
c) Malaria
d) Filariasis

62) The inner mitochondrial membrane comprises of a series of folds known as (GATE XL 2017)

a) Cristae
b) Thylakoids
c) Cisterns
d) Cilia

63) Which one of the following antibiotics is **NOT** produced by *Streptomyces* sp.? (GATE XL 2017)

a) Amphotericin B
b) Neomycin
c) Vancomycin
d) Gentamicin

64) Which one of the following statements is TRUE about MacConkey (MAC) agar medium? (GATE XL 2017)
a) MAC agar medium is a selective and differential medium for Gram-positive bacteria.
b) MAC agar medium is a selective and differential medium for Gram-negative bacteria.
c) MAC agar medium is an enriched medium for Gram-positive bacteria.
d) MAC agar medium is a synthetic medium for Gram-positive and Gram-negative bacteria.

65) As an antiseptic, alcohol is effective against (GATE XL 2017)

a) Bacteria and non-enveloped viruses
b) Bacterial endospores and fungi
c) Bacteria and fungi
d) Fungi and non-enveloped viruses

66) An antigen X was injected into a rabbit for the first time at time P. Then the rabbit was given a booster dose of X at time Q. Which one of the following figures accurately depicts the adaptive immune response by the rabbit against X? (GATE XL 2017)

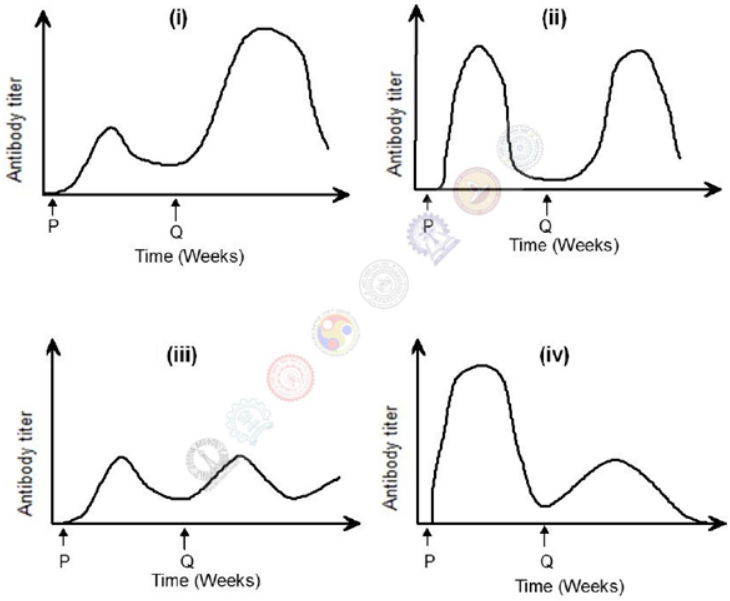

Fig. 8: Adaptive immune response graphs

a) (i)
b) (ii)
c) (iii)
d) (iv)

67) A bactericidal agent X is added after 3 hours of growth of a bacterial culture. Following the addition of X, the bacterial growth was measured using the standard plate count method till 24 hours. Which one of the following figures is the most accurate representation of the action of X? (GATE XL 2017)

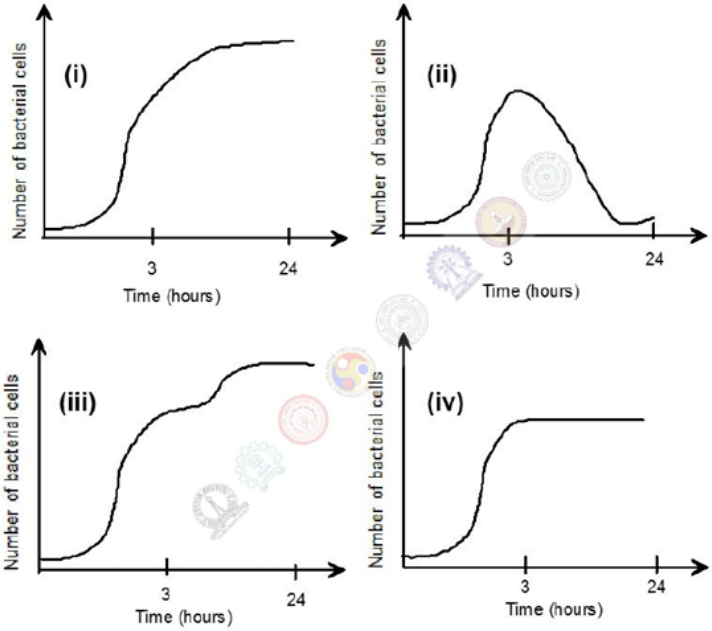

Fig. 9: Action of bactericidal agent X

a) (i)
b) (ii)
c) (iii)
d) (iv)

68) Match the diseases given in **Group I** with their causative agents from **Group II**. (GATE XL 2017)

Group I	**Group II**
P) Plague	I. *Coxiella burnetii*
Q) Rabies	II. *Plasmodium* spp.
R) Q fever	III. *Yersinia pestis*
S) Malaria	IV. *Lyssavirus*

a) P-III, Q-IV, R-I, S-II
b) P-III, Q-I, R-II, S-IV
c) P-II, Q-III, R-I, S-II
d) P-III, Q-I, R-IV, S-II

69) Match the enzymes given in **Group I** with the events from **Group II**. (GATE XL 2017)

Group I	**Group II**
P) UvrABC endonuclease	I. Retrovirus replication
Q) Reverse transcriptase	II. Base excision repair
R) AP endonuclease	III. Nucleotide excision repair
S) ATP sulfurylase	IV. Pyrosequencing

a) P-II, Q-I, R-IV, S-III
b) P-III, Q-I, R-II, S-IV
c) P-IV, Q-III, R-I, S-II
d) P-II, Q-I, R-III, S-IV

70) Match the terms given in **Group I** with the descriptions from **Group II**. (GATE XL 2017)

Group I	**Group II**
P) Photoautotrophs	I. Use inorganic chemical reactions for energy production
Q) Chemoautotrophs	II. Use organic compounds for energy production
R) Photoheterotrophs	III. Use sunlight as energy source and carbon dioxide as carbon source
S) Chemoheterotrophs	IV. Use sunlight as energy source and organic compounds as carbon source

a) P-III, Q-I, R-IV, S-II
b) P-III, Q-I, R-II, S-IV
c) P-IV, Q-III, R-I, S-II
d) P-II, Q-IV, R-III, S-I

71) One-ml sample of a bacterial culture was serially diluted to 10^5 times, and 46 colonies were obtained after plating this diluted sample on an agar medium. The number of cells present per ml in the undiluted original sample were _____ (GATE XL 2017)

72) The transformation efficiency of competent cells prepared in a laboratory is 10^4 CFU/μg of plasmid DNA. If 0.01 μg of this plasmid is used to transform these competent cells, the number of transformed bacteria in CFU after plating will be _____ (GATE XL 2017)

73) Assume that the average DNA content of a single microbial cell is 4 femtogram. A soil sample analyzed for its microbial community DNA is found to contain 0.32 μg DNA per gram of the soil. The number of microbial cells per milligram of the soil are _____ (GATE XL 2017)

74) Assume that a bacterial culture has a mean generation time of 2 hours. If the number of bacteria present after 24 hours of culture are 4.1×10^7, the initial number of bacteria present were _____ (GATE XL 2017)

75) The minimal inhibitory concentration (MIC) of an antibiotic X against *Clostridium tetani*, *Staphylococcus* sp., *Shigella* sp., and *Streptococcus* sp. is 25, 15, 2 and 1 μg/ml, respectively. Assuming that the bioavailable concentration of X in an animal model is 20 μg/ml, which one of these bacteria may develop resistance against X in the animal model? (GATE XL 2017)

a) *Clostridium tetani*
b) *Staphylococcus* sp.
c) *Shigella* sp.
d) *Streptococcus* sp.

Zoology (XL-T)

76) The characteristic feature of deuterostomes is depicted by (GATE XL 2017)

a) coelom formed by the hollowing out of a previously solid cord of mesodermal cells
b) spiral and determinate cleavage
c) formation of mouth from blastopore
d) formation of anus from blastopore

77) One of the most remarkable features of evolution is the formation of amnion and allantois. This appeared for the "first time" in evolutionary time scale in (GATE XL 2017)

a) reptiles
b) birds
c) fishes
d) humans

78) A woman with blood group A gave birth to a baby with blood group AB. The blood group of the father would be (GATE XL 2017)

a) only AB
b) only B
c) either AB or B
d) blood group O

79) The enzyme amylase can break alpha glycosidic linkages between glucose monomers. Hence, amylase can digest which one of the following carbohydrates? (GATE XL 2017)

a) Cellulose
b) Starch
c) Chitin
d) Xylans

80) The metabolic pathway which is common to both fermentation and cellular respiration is (GATE XL 2017)

a) the TCA cycle
b) the electron transport chain
c) glycolysis
d) synthesis of acetyl CoA from pyruvate

81) A female "Spotted sand piper" courts males repeatedly. This behavior can be explained by the term (GATE XL 2017)

a) polyandry
b) polygyny
c) monogamy
d) sexual cannibalism

82) Malaria is caused by *Plasmodium* species, which is a parasite having a complex life cycle. The fusion between male and female gametocytes of *Plasmodium* happens inside (GATE XL 2017)

a) human liver
b) human RBCs
c) mosquito midgut
d) mosquito salivary glands

83) Aromatase inhibitors are often prescribed for post-menopausal women to treat estrogen receptor positive breast cancer patients, because these class of drugs (GATE XL 2017)

a) reduce prostaglandin biosynthesis
b) reduce the level of estradiol biosynthesis
c) inhibit conversion of testosterone to dihydrotestosterone
d) are non-toxic in post-menopausal women

84) The covalent modification performed by kinases which regulate proteins in signaling pathways is (GATE XL 2017)

a) glycosylation
b) methylation
c) ubiquitination
d) phosphorylation

85) Which one of the following statements is NOT correct? (GATE XL 2017)

a) During metaphase, the 2 copies of chromosomal DNA are held together at the centromere
b) The short arm of chromosomes is referred to as p and the long arm is referred to as q
c) The terminal structures at the end of the chromatids are referred to as telomeres
d) The terms heterochromatin and euchromatin refer to the active and repressed regions of the chromosome respectively

86) A particular species is found to have 2n=16 chromosomes. The number of linkage groups in this species will be _____ (GATE XL 2017)

87) In the Meselson and Stahl experiment, *E. coli* was grown in a medium containing $^{15}NH_4Cl$. After 24 hours, *E. coli* were transferred to medium containing $^{14}NH_4Cl$. After the fourth generation in medium containing $^{14}NH_4Cl$, the ratio between hybrids ($^{15}N/^{14}N$) and light ($^{14}N/^{14}N$) labeled DNA will be 1 : *n*, where the value of *n* is _____ (GATE XL 2017)

88) The population data present in an island is as follows (GATE XL 2017)

Genotype	Number
AA	300
Aa	500
aa	200
Total	1000

The allele frequency of *A* (upto two decimals) will be _____

89) A cell in G1 phase has 16 chromosomes. The total number of chromatids that would be found per cell during Metaphase II of meiosis are _____ (GATE XL 2017)

90) Upon activation of phospholipase C by ligand binding to G-protein coupled receptor, the Ca^{2+} concentration in cytosol will (GATE XL 2017)

a) decrease due to blockage of $InsP_3$ gated channel on endoplasmic reticulum
b) decrease due to blockage of $InsP_3$ gated channel on plasma membrane
c) increase due to efflux of Ca^{2+} from $InsP_3$ gated channel on mitochondria
d) increase due to efflux of Ca^{2+} from $InsP_3$ gated channel on endoplasmic reticulum as well as influx of Ca^{2+} from $InsP_3$ gated channel on plasma membrane

91) Match the molecules in **Group I** with their function in **Group II**. (GATE XL 2017)

Group I	**Group II**
P) Transferrin	I. Uptake of glucose
Q) Insulin	II. Binds iron
R) α-macroglobulin	III. Substratum for cell attachment
S) Fibronectin	IV. Proteinase inhibitor
	V. Binds to oxygen in RBC

a) P-III, Q-I, R-IV, S-III
b) P-II, Q-I, R-V, S-III
c) P-II, Q-I, R-IV, S-II
d) P-I, Q-III, R-II, S-V

92) If a heavy chain of an antibody molecule weighs 65,000 Daltons (Da) and a light chain weighs 25,000 Da, the approximate calculated weight of an IgM antibody in Da will be (GATE XL 2017)

a) 90,000
b) 180,000
c) 360,000
d) 900,000

93) Match the signaling pathways in **Group I** with their functions in **Group II**, during the process of development. (GATE XL 2017)

Group I	**Group II**
P) Hedgehog signaling	I. Involved in signaling at 4-cell embryo stage in *C. elegans* through glp 1 expression
Q) Hox proteins	II. Involves frizzled receptor on target cell membrane and establish polarity in insects
R) Wnt signaling	III. Plays critical role in facial morphogenesis in vertebrates and its mutation causes cyclopia
S) Notch signaling	IV. Required for T-bx transcription factor expression for vertebrate limb development

a) P-III, Q-II, R-IV, S-I
b) P-III, Q-IV, R-II, S-I
c) P-IV, Q-II, R-II, S-III
d) P-II, Q-IV, R-I, S-II

94) In a population which is in Hardy-Weinberg equilibrium, the frequency of the recessive genotype of a certain trait is 0.09. The percentage of individuals with heterozygous genotype is _____% (GATE XL 2017)

95) An enzyme preparation has activity of 2 Units per 20 μl, and protein concentration 0.4 mg/ml. The specific activity (Units/mg) of this enzyme will be _____ (GATE XL 2017)

Food Technology (XL-U)

96) Indicate the correct group that contains a monosaccharide, a disaccharide and a trisaccharide. (GATE XL 2017)

a) Glucose, sucrose, mannose
b) Ribose, lactose, raffinose
c) Mannose, maltose, lactose
d) Raffinose, stachyose, glucose

97) In which of the following products, 'must' is used as the substrate for fermentation? (GATE XL 2017)

a) Beer
b) Wine
c) Idli
d) Tempeh

98) Identify the foodborne illness which is not caused by bacteria. (GATE XL 2017)

a) Botulism
b) Listeriosis
c) Vibriosis
d) Cysticercosis

99) Nutrient composition of wheat flour changes with extent of extraction from whole wheat grain. Which of the following statements is true if the extraction rate increased from 50% to 90%? (GATE XL 2017)

a) Starch increases, protein increases, fat increases, mineral increases
b) Starch decreases, protein increases, fat increases, mineral increases
c) Starch decreases, protein decreases, fat increases, mineral decreases
d) Starch decreases, protein increases, fat decreases, mineral decreases

100) You have two samples of milk, one (X) with 3.8% fat and another (Y) with 0.5% fat. In order to produce a milk with 3.5% fat, 100 ml of Y should be mixed with _____ ml of X. (GATE XL 2017)

101) Match the items in Column I with the items in Column II in relation to food safety and standards. (GATE XL 2017)

Column I	**Column II**
P) HACCP	1. International food standards
Q) FSSAI	2. Quality control protocol
R) CIP	3. Food plant sanitation and hygiene protocol
S) CODEX	4. Indian food standards

a) P-2, Q-4, R-3, S-1
b) P-4, Q-3, R-2, S-1
c) P-1, Q-4, R-2, S-3
d) P-4, Q-2, R-3, S-1

102) A 50% sucrose solution at 20°C is flowing at a rate of 3.5 m^3/h through a pipe with an inside diameter of 0.0475 m and length of 12 m. The viscosity and the density of the solution are 15.43 cp and 1232 kg/m^3, respectively. The Reynolds number of the flow is _____. (GATE XL 2017)

103) In a pineapple juice, fibre particles having mean diameter of 160 μm and density of 1075 kg/m^3 are settling by gravity. If the density and viscosity of the juice are 1015 kg/m^3 and 0.98 cp, respectively, terminal velocity of the fibre particles is _____ mm/s. (GATE XL 2017)

104) Power consumption in liquid mixing is proportional to _____. (GATE XL 2017)

a) Power number × liquid density × (rotational speed)^3× (impeller diameter)^5
b) Power number × liquid density × (rotational speed)^2× (impeller diameter)^3
c) Liquid density × viscosity of the liquid × (rotational speed)^2× (impeller diameter)^3
d) Acceleration due to gravity × liquid density × (rotational speed)^3× (impeller diameter)^5

105) In dye-reduction test for estimation of viable microorganisms, the most commonly used dyes are methylene blue, triphenyltetrazolium-chloride and _____. (GATE XL 2017)

a) Malachite green
b) Amaranth
c) Tartrazine
d) Resazurin

106) Match the following items of **Group I** with the items of **Group II** in relation to the quality of fat. (GATE XL 2017)

Group I	**Group II**
P) Saponification number	1. Unsaturation of fatty acid
Q) Iodine number	2. Volatile water soluble fatty acid
R) Reichert Meissl number	3. Hydroxy fatty acid
S) Acetyl value	4. Molecular weight of fatty acid

a) P-1, Q-2, R-3, S-4
b) P-1, Q-3, R-4, S-2
c) P-4, Q-1, R-2, S-3
d) P-2, Q-1, R-3, S-4

107) Match the following metabolic product (**Column I**) that indicates the quality of food (**Column II**). (GATE XL 2017)

Column I	**Column II**
P) Ethanol	1. Canned vegetable
Q) Lactic acid	2. Fish
R) Trimethylamine	3. Butter
S) Volatile fatty acid	4. Apple juice

a) P-3, Q-2, R-4, S-1
b) P-4, Q-1, R-2, S-3
c) P-4, Q-3, R-2, S-1
d) P-3, Q-4, R-2, S-1

108) Correlate the vitamins in **Column I** with their role in promoting reaction/process in **Column II**. (GATE XL 2017)

Column I	**Column II**
P) Riboflavin	1. Visual cycle
Q) Vitamin D	2. Acyl group transfer
R) Pantothenic acid	3. Regulation of Ca^{2+} metabolism
S) Vitamin A	4. Oxidation-reduction reaction

a) P-1, Q-2, R-4, S-3
b) P-2, Q-1, R-3, S-4
c) P-3, Q-4, R-1, S-2
d) P-4, Q-3, R-2, S-1

109) A pure strain with generation time of 60 min is used in a fermentation process. Following inoculation (0 h), the strain takes 2 h for adaptation, 10 h to achieve maximum growth and 12 h to arrive at the point where the death rate is higher than

the growth rate. If the inoculation load is 100 cells, the total population at the end of 10 h will be _____. (GATE XL 2017)

110) Refer to the shear stress-shear rate plot shown in Fig. 10. Match the lines **Column I** with appropriate rheological behavior **Column II**. (GATE XL 2017)

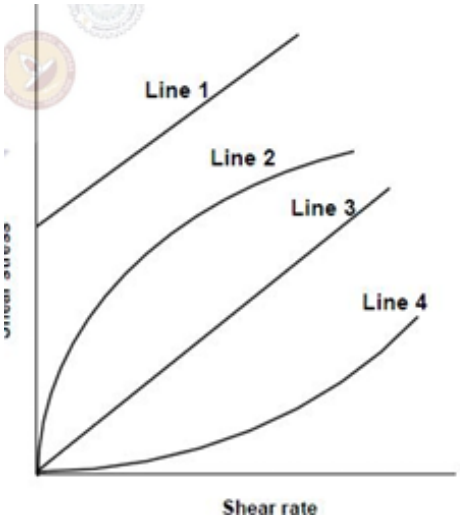

Fig. 10: Shear stress-shear rate plot with Lines 1-4

Column I	**Column II**
P) Line 1	1. Dilatant
Q) Line 2	2. Newtonian
R) Line 3	3. Pseudoplastic
S) Line 4	4. Bingham plastic

a) P-2, Q-3, R-4, S-1
b) P-1, Q-3, R-4, S-2
c) P-2, Q-4, R-3, S-1
d) P-4, Q-3, R-2, S-1

111) Water flowing at a rate of 1 kg/min is heated from 12 to 80 °C with flue gas supplied at a rate of 3 kg/min. The temperature and specific heat of the flue gas are 180 °C and 1.05 kJ/kg.K, respectively. If specific heat of water is 4.2 kJ/kg.K and the flow is parallel, then the logarithmic mean temperature difference will be _____ °C. (GATE XL 2017)

112) The Lineweaver-Burk plot of an enzymatic reaction shows V_{max} of 160 μmol/l.min and K_m of 60 μmol/l. For a substrate concentration of 40 μmol/l, the velocity of the reaction is estimated to be _____ μmol/l.min. (GATE XL 2017)

113) A suspension containing 2×10^4 spores of organism A having a $D_{121.1^\circ C}$ value of 1.5 min and 8×10^5 spores of organism B having a $D_{121.1^\circ C}$ value of 0.8 min is heated at a constant temperature of 121.1 °C. The heating time needed to obtain a probability of spoilage "1 in 1000" is _____ min. (GATE XL 2017)

114) In an evaporation process, a compressor picks up 0.05 m^3 air in each revolution and compresses 500 kg of air per minute. If the specific volume of air is 0.9 m^3/kg, then the compressor speed is _____ rpm. (GATE XL 2017)

115) For a soybean oil extraction system, solvent:soy ratio is maintained at 0.5:1 (w/w). Original seed contains 18% oil (w/w). If the meal (soy solid) after final desolventization has 0.01 kg oil per kg *oil-free* meal, then the effectiveness of the solvent (kg oil/kg solvent) in the extraction process is _____. (GATE XL 2017)

116) The event would have been successful if you _____ able to come. (GATE XL 2017)

a) are
b) had been
c) have been
d) would have been

117) There was no doubt that their work was thorough. Which of the words below is closest in meaning to the underlined word above? (GATE XL 2017)

a) pretty
b) complete
c) sloppy
d) haphazard

118) Four cards lie on a table. Each card has a number printed on one side and a colour on the other. The faces visible on the cards are 2, 3, red, and blue. Proposition: If a card has an even value on one side, then its opposite face is red. The cards which MUST be turned over to verify the above proposition are (GATE XL 2017)

a) 2, red
b) 2, 3, red
c) 2, blue
d) 2, red, blue

119) What is the value of x when $81 \times \left(\frac{16}{25}\right)^{x+2} \div \left(\frac{3}{5}\right)^{2x+4} = 144$? (GATE XL 2017)

a) 1
b) -1
c) 2
d) Cannot be determined

120) Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the top faces of the dice is a perfect square is (GATE XL 2017)

a) 1/9
b) 2/9
c) 1/3
d) 4/9

121) Bhaichung was observing the pattern of people entering and leaving a car service centre. There was a single window where customers were being served. He saw that people inevitably came out of the centre in the order that they went in. However, the time they spent inside seemed to vary a lot: some people came out in a matter of minutes while for others it took much longer. From this, what can one conclude? (GATE XL 2017)

a) The centre operates on a first-come-first-served basis, but with variable service times, depending on specific customer needs
b) Customers were served in an arbitrary order, since they took varying amounts of time for service completion in the centre
c) Since some people came out within a few minutes of entering the centre, the system is likely to operate on a last-come-first-served basis
d) Entering the centre early ensured that one would have shorter service times and most people attempted to do this

122) A map shows the elevations of Darjeeling, Gangtok, Kalimpong, Pelling, and Siliguri. Kalimpong is at a lower elevation than Gangtok. Pelling is at a lower elevation than Gangtok. Pelling is at a higher elevation than Siliguri. Darjeeling is at a higher elevation than Gangtok. Which of the following statements can be inferred from the paragraph above? (GATE XL 2017)

i. Pelling is at a higher elevation than Kalimpong
ii. Kalimpong is at a lower elevation than Darjeeling
iii. Kalimpong is at a higher elevation than Siliguri
iv. Siliguri is at a lower elevation than Gangtok

a) Only ii
b) Only ii and iii
c) Only iii and iv
d) Only iii and iv

123) P, Q, R, S, T and U are seated around a circular table. R is seated two places to the right of Q. P is seated three places to the left of R. S is seated opposite U. If P and U now switch seats, which of the following must necessarily be true? (GATE XL 2017)
a) P is immediately to the right of R
b) T is immediately to the left of P
c) T is immediately to the left of P or P is immediately to the right of Q
d) U is immediately to the right of R or P is immediately to the left of T

124) Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walks is (GATE XL 2017)

a) 1
b) 4
c) 5
d) 6

125) The points in the graph below represent the halts of a lift for durations of 1 minute, over a period of 1 hour. (GATE XL 2017)

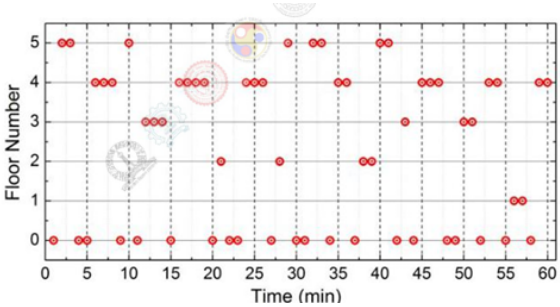

Fig. 11: Lift halts over time

Which of the following statements are correct?

i. The elevator never moves directly from any non-ground floor to another non-ground flo
ii. The elevator stays on the fourth floor for the longest duration over the one hour period

a) Only i
b) Only ii
c) Both i and ii
d) Neither i nor ii