

# IIT JAM 2024 NAT Model Questions

## Subject- Biotechnology (BT)

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Q1. Given that  $A = (\sin\theta \cos\theta \tan\theta + \sin\theta \cos\theta \cot\theta)$ , the value of A is?

Q.2 An object is placed at the principal focus of a concave lens of focal length 10 cm. The image will be formed at \_\_\_\_\_ cm, between the optical centre and the focus of the lens on the same side of the object.

Q.3 What is the maximum number of hydrogen bonds that a water molecule can make in the liquid state?

Q.4 How many pairs of autosomal chromosomes are there in normal humans?

Q.5 Calculate the temperature (in K) at which the resistance of a metal becomes 20% more than its resistance at 300 K. The value of the temperature coefficient of resistance for this metal is  $2.0 \times 10^{-4} /K$ .

Q.6 A variable number of tandem repeats (VNTR) locus has 15 different alleles. The number of genotypes possible in a population for this VNTR is \_\_\_\_\_.

Q.7 The vibrational frequency (expressed in wavenumber) of  $^1\text{H}^{35}\text{Cl}$  is  $2990.6 \text{ cm}^{-1}$ . Assuming that the force constant is same in both the cases, the vibrational frequency (in  $\text{cm}^{-1}$ ) of  $^2\text{D}^{35}\text{Cl}$  is \_\_\_\_\_.

Q.8 The length of the transverse and conjugate axis in a hyperbola are 6 and 8, respectively. The eccentricity of the hyperbola, rounded off to TWO decimal places, is \_\_\_\_\_.

Q.9 A bouncing ball is dropped from an initial height of  $h$  metres above a flat surface. Each time the ball hits the surface, it rebounds a distance  $r \times h$  metres and it bounces indefinitely. Consider the value of  $h = 5$  metres and  $r = 1/3$ . The total vertical distance (up and down) travelled (in metres) by the ball is \_\_\_\_\_.

Q.10 One point charge ( $q$ ) each, is placed along a line at 3 different points  $x = 0$ ,  $x = 2 \text{ nm}$  and  $x = 6 \text{ nm}$ . The force between two charges separated by 2 nm is 2 piconewton (pN). The magnitude of force (in pN) on the charge in the middle due to the other two charges is \_\_\_\_\_.

Q.11 The prevalence of a severe form of sickle-cell anemia (ss) in an African population is 16%. The percentage of the population resistant to malaria because of heterozygous (Ss) genotype for the sickle-cell gene is \_\_\_\_\_.

Q.12 The maximum velocity of an enzymatic reaction is 0.4 mole/sec. At 5 mM concentration of the substrate, the reaction velocity was found to be 0.2 mole/sec. If the enzyme shows standard Michaelis-Menten kinetics, the rate of the reaction at 10 mM substrate concentration in mole/sec is \_\_\_\_ (decimal digits up to 3 places)

Q.13 A chromatin fibre of 40 nm length contains 25 nucleosomes (200 bp per nucleosome). The degree of compaction of DNA associated with this chromatin fibre is \_\_\_\_ fold (decimal digits up to 1 place)

Q.14 A ball is dropped from a height of 1 metre. Every time the ball bounces up, it reaches 50% of the height of the previous bounce (i.e., it rises up to 0.5 metres on the first bounce, 0.25 metres on the second bounce and so on). After an infinitely long time, the total distance covered by the ball in m is \_\_\_\_ .

Q.15 Rod shaped E. coli is 2 m long and has a diameter of 0.8 m. The average density of E. coli is  $1.1 \times 10^3$  g/L. The mass of single E. coli cell in pg is \_\_\_\_ (decimal digits up to 1 place).

## ANSWER KEY

Question No.	Question Type (QT)	Subject Name (SN)	Key/Range (KY)	Mark (MK)
1	NAT	BT	1	1
2	NAT	BT	5 or 5	1
3	NAT	BT	4	1
4	NAT	BT	22	1
5	NAT	BT	1300	1
6	NAT	BT	120 to 120	2
7	NAT	BT	2100 to 2200	2
8	NAT	BT	1.60 to 1.80	2
9	NAT	BT	10 to 10	2
10	NAT	BT	1.5 to 1.5	2

<b>11</b>	NAT	BT	47 to 49	2
<b>12</b>	NAT	BT	0.261 to 0.269	2
<b>13</b>	NAT	BT	42.1 to 42.7	2
<b>14</b>	NAT	BT	2.9 to 3.1	2
<b>15</b>	NAT	BT	1.0 to 1.2	2

