

**GENERAL APTITUDE**

**Q. No. 1- 5 Carry One Mark Each**

1. A number is as much greater than 75 as it is smaller than 117. The number is:  
(A) 91                      (B) 93                      (C) 89                      (D) 96

**Answer: (D)**

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2. The professor ordered to the students to go out of the class.  
I II III IV  
Which of the above underlined parts of the sentence is grammatically incorrect?  
(A) I                      (B) II                      (C) III                      (D) IV

**Answer: (B)**

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3. Which of the following options is the closest in meaning to the word given below:  
Primeval  
(A) Modern                      (B) Historic                      (C) Primitive                      (D) Antique

**Answer: (C)**

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4. Friendship, no matter how \_\_\_\_\_ it is, has its limitations.  
(A) cordial                      (B) intimate                      (C) secret                      (D) pleasant

**Answer: (B)**

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5. Select the pair that best expresses a relationship similar to that expressed in the pair:  
Medicine: Health  
(A) Science: Experiment                      (B) Wealth: Peace  
(C) Education: Knowledge                      (D) Money: Happiness

**Answer: (C)**

**Q.No. 6 - 10 Carry Two Marks Each**

6. X and Y are two positive real numbers such that  $2X + Y \leq 6$  and  $X + 2Y \leq 8$ . For which of the following values of (X, Y) the function  $f(X, Y) = 3X + 6Y$  will give maximum value?
- (A) (4/3, 10/3) (B) (8/3, 20/3)  
(C) (8/3, 10/3) (D) (4/3, 20/3)

**Answer: (A)**

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7. If  $|4X - 7| = 5$  then the values of  $2|X| - |-X|$  is:
- (A) 2, 1/3 (B) 1/2, 3 (C) 3/2, 9 (D) 2/3, 9

**Answer: (B)**

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8. Following table provides figures (in rupees) on annual expenditure of a firm for two years 2010 and 2011.

Category	2010	2011
Raw material	5200	6240
Power & fuel	7000	9450
Salary & wages	9000	12600
Plant & machinery	20000	25000
Advertising	15000	19500
Research & Development	22000	26400

In 2011, which of the following two categories have registered increase by same percentage?

- (A) Raw material and Salary & wages  
(B) Salary & wages and Advertising  
(C) Power & fuel and Advertising  
(D) Raw material and Research & Development

**Answer: (D)**

9. A firm is selling its product at Rs. 60 per unit. The total cost of production is Rs. 100 and firm is earning total profit of Rs. 500. Later, the total cost increased by 30%. By what percentage the price should be increased to maintained the same profit level.

- (A) 5                      (B) 10                      (C) 15                      (D) 30

**Answer: (A)**

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10. Abhishek is elder to Savar.

Savar is younger to Anshul.

Which of the given conclusions is logically valid and is inferred from the above statements?

- (A) Abhishek is elder to Anshul  
(B) Anshul is elder to Abhishek  
(C) Abhishek and Anshul are of the same age  
(D) No conclusion follows

**Answer: (D)**

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### BIOTECHNOLOGY ENGINEERING

#### Q.No. 1–25 Carry One Mark Each

1. Under alkaline conditions, DNA is more stable than RNA because

- (A) RNA forms secondary structures  
(B) RNA is a single stranded molecule  
(C) RNA has uracil in place of thymidine  
(D) RNA is susceptible to hydrolysis

**Answer: (D)**

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2. Which one of the following modifications is common to both protein and DNA?

- (A) SUMOylation      (B) Nitrosylation      (C) Methylation      (D) Ubiquitination

**Answer: (C)**

3. Protein A, which has strong affinity to Fc region of immunoglobulin, is extracted from
- (A) *Saccharomyces cerevisiae* (B) *Staphylococcus aureus*  
(C) *Streptococcus pyogenes* (D) *Streptococcus sanguis*

**Answer: (B)**

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4. The first humanized monoclonal antibody approved for the treatment of breast cancer is
- (A) Rituximab (B) Cetuximab (C) Bevacizumab (D) Herceptin

**Answer: (D)**

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5. Which one of the following amino acids in proteins does NOT undergo phosphorylation?
- (A) Ser (B) Thr (C) Pro (D) Tyr

**Answer: (C)**

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6. The role of an adjuvant is to
- (A) prolong the persistence of antigen (B) cross link the antigen  
(C) increase the size of antigen (D) avoid inflammation

**Answer: (A)**

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7. Endogenous antigens are presented on to the cell surface along with
- (A) MHC-II (B) MHC-I  
(C) Fc $\gamma$ receptor (D) Complement receptor

**Answer: (B)**

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8. Human genome sequencing project involved the construction of genomic library in
- (A) Bacterial artificial chromosome (B) pBR322  
(C) Bacteriophage (D) pcDNA3.1

**Answer: (A)**

9. The nucleotide analogue used in DNA sequencing by chain termination method is
- (A) 1',3'-dideoxy nucleoside triphosphate      (B) 2',3'-dideoxy nucleoside triphosphate  
(C) 2',4'-dideoxy nucleoside triphosphate      (D) 2',5'-dideoxy nucleoside triphosphate

**Answer: (B)**

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10. In nature, the horizontal gene transfer across bacteria is mediated by
- (A) Gene cloning followed by transformation  
(B) Conjugation and transformation  
(C) Conjugation only  
(D) Transformation only

**Answer: (B)**

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11. Phylum proteobacteria is subdivided into  $\alpha$ -,  $\beta$ -,  $\gamma$ - and  $\epsilon$ - proteobacteria based on
- (A) G+C content      (B) 23S rRNA sequences  
(C) tRNA sequences      (D) 16S rRNA sequences

**Answer: (D)**

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12. Which of the following is an ABC transporter?
- (A) Multidrug resistance protein      (B) Acetylcholine receptor  
(C) Bacteriorhodopsin      (D) ATP synthase

**Answer: (A)**

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13. The catalytic efficiency for an enzyme is defined as
- (A)  $k_{cat}$       (B)  $\frac{v_{max}}{k_{cat}}$       (C)  $\frac{k_{cat}}{k_m}$       (D)  $\frac{k_{cat}}{v_{max}}$

**Answer: (C)**

14 Of the two diploid species, species I has 36 chromosomes and species II has 28 chromosomes. How many chromosomes would be found in an allotriploid individual?

- (A) 42 or 54                      (B) 46 or 50                      (C) 74 or 86                      (D) 84 or 108

**Answer: (B)**

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15. The RNA primer synthesized during the replication process in bacteria is removed by

- (A) DNA gyrase                      (B) Primase  
(C) DNA polymerase I                      (D) DNA polymerase II

**Answer: (C)**

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16. The suitable substitution matrix to align closely related sequences is

- (A) PAM 250 or BLOSSUM 80                      (B) PAM 40 or BLOSSUM 80  
(C) PAM 120 or BLOSSUM 40                      (D) PAM 250 or BLOSSUM 40

**Answer: (B)**

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17. If  $P = \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$ ,  $Q = \begin{bmatrix} 2 & 1 \\ 2 & 2 \end{bmatrix}$  and  $R = \begin{bmatrix} 3 & 0 \\ 1 & 3 \end{bmatrix}$ , which one of the following statements is TRUE?

- (A)  $PQ = PR$                       (B)  $QR = RP$                       (C)  $QP = RP$                       (D)  $PQ = QR$

**Answer: (A)**

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18. If  $u = \log(e^x + e^y)$ , then  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} =$

- (A)  $e^x + e^y$                       (B)  $e^x - e^y$                       (C)  $\frac{1}{e^x + e^y}$                       (D) 1

**Answer: (D)**

19. Hypophosphatemia is manifested by an X-linked dominant allele. What proportion of the offsprings from a normal male and an affected heterozygous female will manifest the disease?
- (A)  $\frac{1}{2}$  sons and  $\frac{1}{2}$  daughters                      (B) All daughters and no sons
- (C) All sons and no daughters                      (D)  $\frac{1}{4}$  daughters and  $\frac{1}{4}$  sons

**Answer: (A)**

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20. One of the eigen values of  $P = \begin{bmatrix} 10 & -4 \\ 18 & -12 \end{bmatrix}$  is
- (A) 2                      (B) 4                      (C) 6                      (D) 8

**Answer: (C)**

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21. A callus of 5 g dry weight was inoculated on semi-solid medium for growth. The dry weight of the callus was found to increase by 1.5 fold after 10 days of inoculation. The growth index of the culture is \_\_\_\_\_.

**Answer: (0.5)**

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22. A chemostat is operated at a dilution rate of  $0.6 \text{ h}^{-1}$ . At steady state, the biomass concentration in the exit stream was found to be  $30 \text{ g l}^{-1}$ . The biomass productivity ( $\text{g l}^{-1}\text{h}^{-1}$ ) after 3h of steady state operation will be \_\_\_\_\_.

**Answer: (D)**

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23. A batch bioreactor is to be scaled up from 10 to 10,000 liters. The diameter of the large bioreactor is 10 times that of the small bioreactor. The agitator speed in the small bioreactor is 450 rpm. Determine the agitator speed (rpm) of the large bioreactor with same impeller tip speed as that of the small bioreactor \_\_\_\_\_.

**Answer: (45)**

24. Calculate the percentage sequence identity for the pairwise alignment given below:

HELLO –  
YELLOW

**Answer: (B)**

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25. In a batch culture, the specific rate of substrate utilization is  $0.25 \text{ g (g cell mass)}^{-1} \text{ h}^{-1}$  and specific rate of product formation is  $0.215 \text{ g (g cell mass)}^{-1} \text{ h}^{-1}$ . Calculate the yield of product from the substrate ( $Y_{p/s}$ ) \_\_\_\_\_.

**Answer: (0.86)**

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Q. No. 26 – 55 Carry Two Marks Each

26. Match the commercial microbial sources in Group I with the products in Group II.

Group I	Group II
P. <i>Corynebacterium lilium</i>	1. 2,3-Butane di-ol
Q. <i>Klebsiella oxytoca</i>	2. Poly- $\beta$ -hydroxybutyric acid
R. <i>Aspergillus niger</i>	3. Glutamic acid
S. <i>Alcaligenes eutrophus</i>	4. Citric acid

(A) P-3,Q-1,R-2,S-4

(B) P-3,Q-1,R-4,S-2

(C) P-1,Q-3,R-2,S-4

(D) P-1,Q-3,R-4,S-2

**Answer: (B)**

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27. Match the entries in the Group I with the elution conditions in Group II.

Group I	Group II
P. Ion-exchange chromatography	1. Isocratic solvent
Q. Hydrophobic column chromatography	2. Ampholytes
R. Gel filtration chromatography	3. Increasing gradient of salt
S. Chromatofocusing	4. Decreasing gradient of polarity

(A) P-4,Q-1,R-2,S-3

(B) P-4,Q-3,R-1,S-2

(C) P-3,Q-4,R-1,S-2

(D) P-3,Q-4,R-2,S-1

**Answer: (B)**

28. Determine the correctness or otherwise of the following Assertion (a) and Reason (r).

**Assertion:** Immobilization of plant cells can enhance secondary metabolite production during bioreactor cultivation.

**Reason:** Immobilization protects the plant cells from shear forces in the bioreactor.

(A) Both (a) and (r) are true and (r) is the correct reason for (a).

(B) Both (a) and (r) are true but (r) is not the correct reason for (a).

(C) (a) is true but (r) is false.

(D) (a) is false but (r) is true.

**Answer: (A)**

29. Match the cell structures in Group I with the organisms in Group II.

Group I	Group II
P. Endospores	1. Methanobacterium
Q. Bipolar flagella	2. Treponema
R. Pseudomurine in cell wall	3. Spirillum
S. Periplasmic flagella	4. Clostridium

(A) P-4, Q-3, R-1, S-2

(B) P-4, Q-3, R-2, S-1

(C) P-3, Q-4, R-1, S-2

(D) P-4, Q-1, R-3, S-2

**Answer: (A)**

30. Match the antibiotics in Group I with the targets in Group II.

Group I	Group II
P. Sulfonamide	1. Peptidoglycan synthesis
Q. Quinolones	2. Peptide chain elongation
R. Erythromycin	3. Folic acid biosynthesis
S. Cephalosporin	4. Topoisomerase

(A) P-3, Q-4, R-1, S-2

(B) P-2, Q-4, R-3, S-1

(C) P-4, Q-1, R-2, S-3

(D) P-3, Q-4, R-2, S-1

**Answer: (D)**

31. In nature, *Agrobacterium tumefaciens* mediated infection of plant cells leads to

P. crown gall disease in plants

Q. hairy root disease in plants

R. transfer of T-DNA into the plant chromosome

S. transfer of Ri-plasmid into the plant cell

(A) S only

(B) P and R only

(C) Q and S only

(D) Q only

**Answer: (B)**

32. Match the entries in Group I with the enzymes in Group II.

Group I	Group II
P. NAD <sup>+</sup>	1. Glutathione peroxidase
Q. Selenium	2. Nitrogenase
R. Pyridoxal phosphate	3. Lactate dehydrogenase
S. Molybdenum	4. Glycogen phosphorylase

(A) P-3, Q-2, R-4, S-1

(B) P-4, Q-1, R-3, S-2

(C) P-3, Q-1, R-4, S-2

(D) P-3, Q-4, R-2, S-1

**Answer: (C)**

33. Match the herbicides in Group I with the target enzymes in Group II.

Group I	Group II
P. Glyphosate	1. Nitrilase
Q. Bromoxynil	2. Acetolactatesynthetase
R. Sulphonylureas	3. Dehalogenase
S. Dalapon	4. 5-Enolpyruvyl shikimate

(A) P-4, Q-1, R-2, S-3

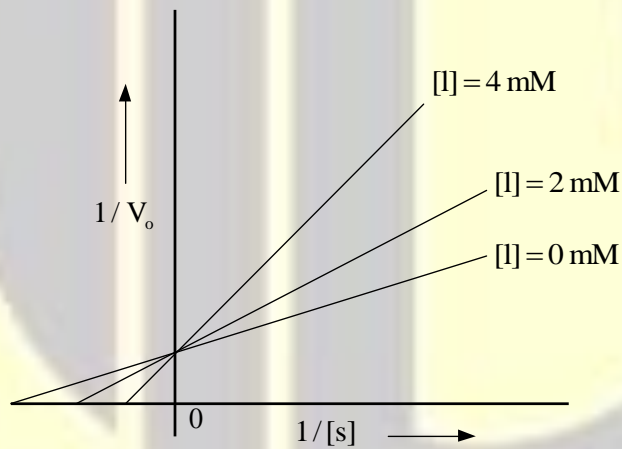
(B) P-2, Q-1, R-4, S-3

(C) P-4, Q-3, R-2, S-1

(D) P-3, Q-2, R-4, S-1

**Answer: (A)**

34. The activity of an enzyme was measured by varying the concentration of the substrate (S) in the presence of three different concentrations of inhibitor (I) 0, 2 and 4 mM. The double reciprocal plot given below suggests that the inhibitor (I) exhibits



(A) substrate inhibition

(B) uncompetitive inhibition

(C) mixed inhibition

(D) competitive inhibition

**Answer: (D)**

35. Match the entries in Group I with the entries in Group II.

Group I	Group II
P. RNase P	1. Polyadenylation
Q. RNase H	2. Splicing
R. snRNAs	3. Ribozymes
S. CstF	4. DNA-RNA hybrids

(A) P-3, Q-4, R-2, S-1

(B) P-4, Q-3, R-2, S-1

(C) P-3, Q-2, R-1, S-4

(D) P-2, Q-4, R-1, S-3

**Answer: (A)**

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36. Determine the correctness or otherwise of the following Assertion (a) and Reason (r).

**Assertion:** UPGMA method produces ultrametric tree.

**Reason:** Sequence alignment is converted into evolutionary distances in UPGMA method.

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true and (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

**Answer: (B)**

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37. Match the entries in the Group I with the entries in Group II.

Group I	Group II
P. Threading	1. Gene duplication
Q. FASTA	2. Fold prediction
R. Profile	3. HMM
S. Paralogs	4. k-tuple

(A) P-2, Q-1, R-3, S-4

(B) P-2, Q-4, R-3, S-1

(C) P-3, Q-4, R-2, S-

(D) P-1, Q-4, R-3, S-2

**Answer: (B)**

38. Evaluate  $\lim_{x \rightarrow \infty} x \tan \frac{1}{x}$
- (A)  $\infty$                       (B) 1                      (C) 0                      (D) -1

**Answer: (B)**

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39. The Laplace transform of  $f(t) = 2t + 6$  is
- (A)  $\frac{1}{s} + \frac{2}{s^2}$                       (B)  $\frac{3}{4} - \frac{6}{s^2}$                       (C)  $\frac{6}{s} + \frac{2}{s^2}$                       (D)  $-\frac{6}{s} + \frac{2}{s^2}$

**Answer: (C)**

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40. The solution of the following set of equations is
- $$\begin{aligned}x + 2y + 3z &= 20 \\7x + 3y + z &= 13 \\x + 6y + 2z &= 0\end{aligned}$$
- (A)  $x = -2, y = 2, z = 8$                       (B)  $x = 2, y = -3, z = 8$   
(C)  $x = 2, y = 3, z = -8$                       (D)  $x = 8, y = 2, z = -3$

**Answer: (B)**

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41. The solution to  $\frac{dy}{dx} + y \cot x = \operatorname{cosec} x$  is
- (A)  $y = (c+x) \cot x$                       (B)  $y = (c+x) \operatorname{cosec} x$   
(C)  $y = (c+x) \operatorname{cosec} x \cot x$                       (D)  $y = (c+x) \frac{\operatorname{cosec} x}{\cot x}$

**Answer: (B)**

42. A complete restriction digestion of a circular plasmid (5000bp) was carried out with *HindIII*, *BamHI* and *EcoRI* individually. Restriction digestion yielded following fragments.

Plasmid + *HindIII* → 1200bp and 3800bp

Plasmid + *BamHI* → 5000bp

Plasmid + *EcoRI* → 2500bp

The number of sites for *EcoRI*, *BamHI* and *HindIII* present on this plasmid are

- (A) *EcoRI*-2, *BamHI*-1, *HindIII*-2                      (B) *EcoRI*-1, *BamHI*-1, *HindIII*-2  
(C) *EcoRI*-3, *BamHI*-2, *HindIII*-1                      (D) *EcoRI*-2, *BamHI*-2, *HindIII*-1

**Answer: (A)**

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43. The total number of fragments generated by the complete and sequential cleavage of the polypeptide given below by Trypsin followed by CNBr is \_\_\_\_\_.

Phe-Trp-Met-Gly-Ala-Lys-Leu-Pro-Met-Asp-Gly-Arg-Cys-Ala-Gln

**Answer: (5)**

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44. In a genetic study, 80 people were found to have alleles for polydactyly. Only 36 of them were polydactylous. What is the extent of penetrance percentage? \_\_\_\_\_.

**Answer: (C)**

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45. One percent of the cars manufactured by a company are defective. What is the probability (upto four decimals) that more than two cars are defective, if 100 cars are produced ?

**Answer: (C)**

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46. The maximum cell concentration ( $\text{g l}^{-1}$ ) expected in a bioreactor with initial cell concentration of  $1.75 \text{ g l}^{-1}$  and an initial glucose concentration of  $125 \text{ g l}^{-1}$  is ( $Y_{x/s} = 0.6 \text{ g cell/g substrate}$ ) \_\_\_\_\_.

**Answer: (76.75)**

47. A fed batch culture was operated with intermittent addition of glucose solution at a flow rate of 200 ml h<sup>-1</sup>. The values of  $K_s$ ,  $K_s, \mu_m$  and  $D$  are 0.3 g l<sup>-1</sup>, 0.4 h<sup>-1</sup> and 0.1 h<sup>-1</sup>, respectively. Determine the concentration of growth limiting substrate (gl-1) in the reactor at quasi-steady state \_\_\_\_\_.

**Answer: (0.1)**

**Common Data Questions: 48 & 49**

A solution was prepared by dissolving 100 mg of protein X in 100 ml of water. Molecular weight of protein X is 15,000 Da; Avogadro's number = 6.022x 10<sup>23</sup>.

48. Calculate the molarity ( $\mu\text{M}$ ) of the resulting solution.  
 (A) 66.6                      (B) 6.6                      (C) 0.67                      (D) 0.067

**Answer: (A)**

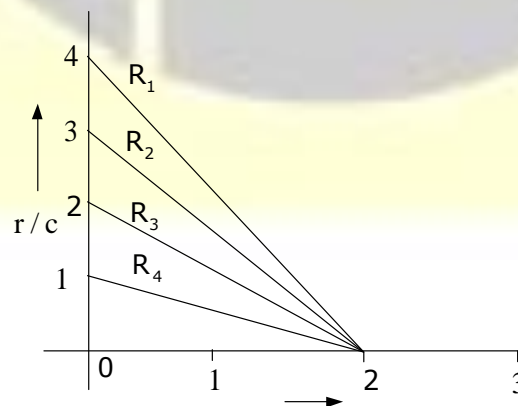
49. The number of molecules present in this solution is  
 (A)  $40.15 \times 10^{19}$       (B)  $6.023 \times 10^{19}$       (C)  $4.015 \times 10^{19}$       (D)  $0.08 \times 10^{19}$

**Answer: (\*)**

**Common Data Questions: 50 & 51**

The binding efficiency of three different receptors  $R_1$ ,  $R_2$  and  $R_3$  were tested against a ligand using equilibrium dialysis, with a constant concentration of receptor and varying concentrations of ligand. The Scatchard plot of receptor titration with different concentration of ligand is given below:

( $r$  is moles of bound ligand per moles of receptor and  $c$  is concentration of free ligand)



50. The number of ligand binding sites present on receptors R1 and R3, respectively are  
(A) 1 and 4                      (B) 1 and 1                      (C) 4 and 1                      (D) 2 and 2

**Answer: (D)**

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51. Which one of the receptors has the highest affinity for the ligand?  
(A) R1                      (B) R2                      (C) R3                      (D) R4

**Answer: (A)**

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**Statement for Linked Answer Questions: 52 & 53**

A DNA fragment of 5000bp needs to be isolated from *E.coli* (genome size 4x103kb) genomic library.

52. The minimum number of independent recombinant clones required to represent this fragment in genomic library are  
(A)  $16 \times 10^2$                       (B)  $12 \times 10^2$                       (C)  $8 \times 10^2$                       (D)  $1.25 \times 10^2$

**Answer: (C)**

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53. The number of clones to represent this fragment in genomic library with a probability of 95% are  
(A)  $5.9 \times 10^3$                       (B)  $4.5 \times 10^3$                       (C)  $3.6 \times 10^3$                       (D)  $2.4 \times 10^3$

**Answer: (B)**

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**Statement for Linked Answer Questions: 54 & 55**

During sterilization of a fermentation medium in a given bioreactor  $\nabla_{\text{heating}} = 12.56$ ,  $\nabla_{\text{cooling}} = 7.48$  and the total value of  $\nabla$  required for whole sterilization process is 52, where  $\nabla$  is the design criteria.

54. What is the value of  $\nabla$  holding?

- (A) 31.96                      (B) 42.32                      (C) 52.43                      (D) 61.18

**Answer: (A)**

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55. What is the holding period (min) at a k value of  $3.36\text{min}^{-1}$ ?

- (A) 10.6                      (B) 9.5                      (C) 8.4                      (D) 7.2

**Answer: (B)**