# GENERAL APTITUDE

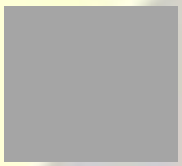
## Q. No. 1 - 5 Carry One Mark Each

**1.** A polygon is convex if, for every pair of points, P and Q belonging to the polygon, the line segment PQ lies completely inside or on the polygon.

Which one of the following is NOT a convex polygon?

(A) 

(B) 

(C) 

(D) 

**Answer: (B)** Click here to watch video explanation

**2.** _____ is to surgery as writer is to _____.

Which one of the following options maintains a similar logical relation in the above sentence?

(A) Doctor, book

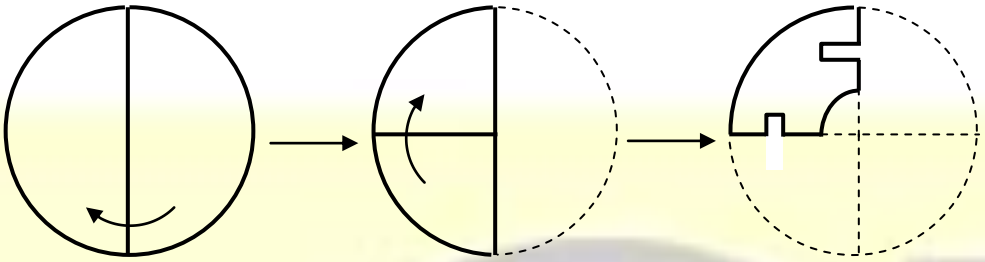
(B) Plan, outline

(C) Medicine, grammar

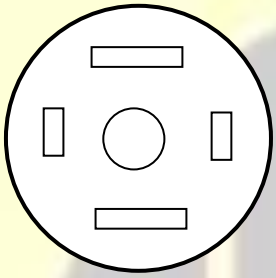
(D) Hospital, library

**Answer: (A)** Click here to watch video explanation

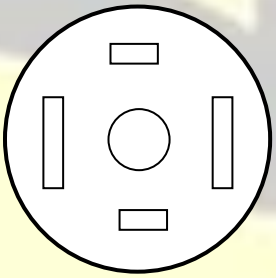
**3.** A circular sheet of paper is folded along the lines in the directions shown. The paper, after being punched in the final folded state as shown and unfolded in the reverse order of folding, will look like



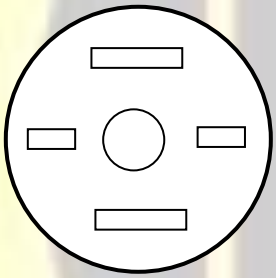
(A)



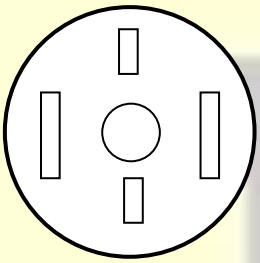
(B)



(C)



(D)



**Answer: (A)** Click here to watch video explanation

**4.** Consider the following sentences:

**(i)** Everybody in the class is prepared for the exam.

**(ii)** Babu invited Danish to his home because he enjoys playing chess.

Which of the following is the CORRECT observation about the above two sentences?

(A) (i) is grammatically incorrect and (ii) is unambiguous

(B) (i) is grammatically correct and (ii) is unambiguous

(C) (i) is grammatically correct and (ii) is ambiguous

(D) (i) is grammatically incorrect and (ii) is ambiguous

**Answer: (C)** Click here to watch video explanation

**5.** The ratio of boys to girls in a class is 7 to3.

Among the options below, an acceptable value for the total number of students in the class is:

(A) 21 (B) 73 (C) 37 (D) 50

**Answer: (D)** Click here to wa tch video explanation

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

**6.**

| Items | Cost (Rs) | Profit % | Marked Price |
|---|---|---|---|
| P | 5, 4000 | … | 5,860 |
| Q | … | 25 | 10,000 |

Details of prices of two items P and Q are presented in the above table. The ratio of cost item P to cost of item Q is 3:4. Discount is calculated as the difference between the marked price and the selling price. The profit percentage is calculated as the ratio of the difference between selling price and cost, to the cost

$$\left(\text{Profit }\% = \frac{\text{Selling price} - \text{Cost}}{\text{Cost}} \times 100\right)$$

The discount on item Q, as a percentage of its marked price, is _____

(A) 25 (B) 10 (C) 12.5 (D) 5

**Answer: (B)** Click here to watch video explanation

**7.** Given below are two statements 1 and 2, and two conclusions I and II.

**Statement 1:** All bacteria are microorganisms.

**Statement 2:** All pathogens are microorganisms.

**Conclusion I:** Some pathogens are bacteria.

**Conclusion II:** All pathogens are not bacteria.

Based on the above statements and conclusions, which one of the following options is logically CORRECT?

(A) Only conclusion II is correct (B) Either conclusion I or II is correct

(C) Neither conclusion I nor II is correct (D) Only conclusion I is correct

**Answer: (C)** Click here to watch video explanation

**8.** There are five bags each containing identical sets of ten distinct chocolates. One chocolate is picked from each bag.

(A) 0.6979 (B) 0.3024 (C) 0.8125 (D) 0.4235

**Answer: (A)** Click here to watch video explanation

**9.** We have 2 rectangular sheets of paper, M and N, of dimension 6 cm × 1 cm each. Sheet M is rolled to form an open cylinder by bringing the short edges of the sheet together. Sheet N is cut into equal square patches and assembled to form the largest possible closed cube. Assuming the ends of the cylinder are closed, the ratio of the volume of the cylinder to that of the cube is _____.

(A) $3\pi$ (B) $\frac{9}{\pi}$ (C) $\frac{3}{\pi}$ (D) $\frac{\pi}{2}$

**Answer: (B)** Click here to watch video explanation

**10.** Some people suggest anti-obesity measures (AOM) such as displaying calorie information in restaurant menus, such measures sidestep addressing the core problem that cause obesity: poverty and income inequality.

Which one of the following statements summarizes the passage?

(A) AOM are addressing the core problems and are likely to succeed

(B) If obesity reduces, poverty will naturally reduce, since obesity causes poverty

(C) The proposed AOM addresses the core problems that cause obesity

(D) AOM are addressing the problem superficially

**Answer: (D)** Click here to watch video explanation

# BIOTECHNOLOGY

## Q. No. 1 to 25 Carry One Mark Each

**1.** Decimal reduction time of a bacterial strain is 20 min. Specific death rate constant in $min^{-1}$ (rounded off to two decimal places) is _____.

**Answer: (0.12)** **Click here to watch video explanation**

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**2.** Under standard temperature (T) and pressure (P) conditions, 128g of an ideal gas molecule A occupies a volume of 1L. The gas molecule A obeys the relationship RT = 0.25PV. R and V are universal gas constant and ideal gas volume, respectively. The molecule A is

(A) $CO_2$ (B) $O_2$ (C) $N_2$ (D) $H_2$

**Answer: (B)** **Click here to watch video explanation**

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**3.** $\frac{d}{dx}\left[\ell n(2x)\right]$ is equal to

(A) x (B) $\frac{1}{2}$ (C) $\frac{1}{x}$ (D) $\frac{1}{2x}$

**Answer: (C)** **Click here to watch video explanation**

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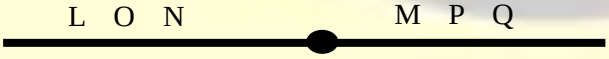
**4.** The order of genes present in a chromosome is as follows


Which one of the following rearrangements represents a paracentric inversion?

(A)



(B)



(C)



(D)



**Answer: (C)** **Click here to watch video explanation**

**5.** Which one of the following methods is used to test the significance of a predicted phylogeny?

(A) Minimum evolution (B) Maximum likelihood

(C) Maximum parsimony (D) Bootstrap

**Answer: (D)** **Click here to watch video explanation**

**6.** CRISPR-Cas system is associated with

(A) adaptive immunity in eukaryotes (B) innate immunity in eukaryotes

(C) adaptive immunity in prokaryotes (D) innate immunity in prokaryotes

**Answer: (C)** **Click here to watch video explanation**

**7.** A protein without its prosthetic group is known as

(A) lipoprotein (B) apoprotein (C) holoprotein (D) hemoprotein

**Answer: (B)** **Click here to watch video explanation**

**8.** The enzyme which adds phosphate group to the free $5'$ terminus of a DNA sequence is

(A) polynucleotide kinase (B) adenosine kinase

(C) terminal deoxynucleotidyl transferase (D) alkaline phosphatase

**Answer: (A)** **Click here to watch video explanation**

**9.** Three balls, colored in blue, green and red, are successively transferred from box A to box B in the order BLUE-GREEN-RED. The probability of a reverse transfer of the balls to the box A in the same order (rounded off to two decimal places) is _____.

**Answer: (0.7)** **Click here to watch video explanation**

**10.** The value of $\lim_{x\to 0}\left[\frac{x-\sin 2x}{x-\sin 5x}\right]$ (rounded off to two decimal places) is _____.

**Answer: (0.23)** **Click here to watch video explanation**

**11.** Which one of the following cell organelle(s) is/are surrounded by a single phospholipid membrane?

(A) Nucleus (B) Mitochondria (C) Lysosome (D) Golgi apparatus

**Answer: (C, D)** **Click here to watch video explanation**

**12.** Coronavirus genome consists of

(A) positive-sense single-stranded RNA (B) double-stranded RNA

(C) negative-sense single-stranded RNA (D) double-stranded DNA

**Answer: (A)** **Click here to watch video explanation**

**13.** The enzyme α-amylase used in starch hydrolysis has an affinity constant $(K_m)$ value of 0.005M. To achieve one-fourth of the maximum rate of hydrolysis, the required starch concentration in mM (rounded off to two decimal places) is _____.

**Answer: (1.67)** **Click here to watch video explanation**

**14.** Which one of the following statements is INCORRECT about hybridoma production?

(A) Polyethylene glycol is used to fuse myeloma cells to B-cells

(B) Hybridoma cells can use hypoxanthine and thymidine

(C) Hybridoma cells are made to produce polyclonal antibodies

(D) DNA synthesis in myeloma cells is blocked by aminopterin

**Answer: (C)** **Click here to watch video explanation**

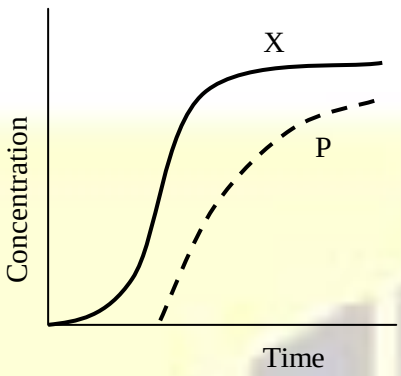
**15.** The Cartesian coordinates (x, y) of a point A with polar coordinates $\left(4, \frac{\pi}{4}\right)$ is

(A) $\left(2, 2\sqrt{3}\right)$ (B) $\left(\sqrt{3}, 2\sqrt{2}\right)$ (C) $\left(2\sqrt{2}, 2\sqrt{2}\right)$ (D) $\left(2\sqrt{2}, \sqrt{3}\right)$

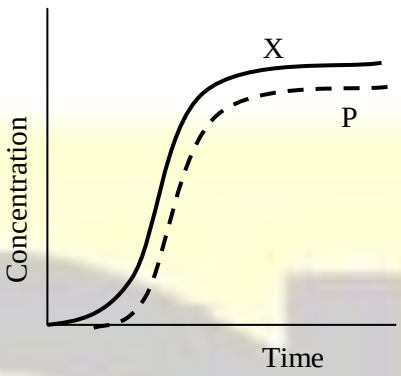
**Answer: (C)** **Click here to watch video explanation**

**16.** Which one of the following represents non-growth associated product formation kinetics in a bioprocess system? X and P denote viable cell and product concentration, respectively.

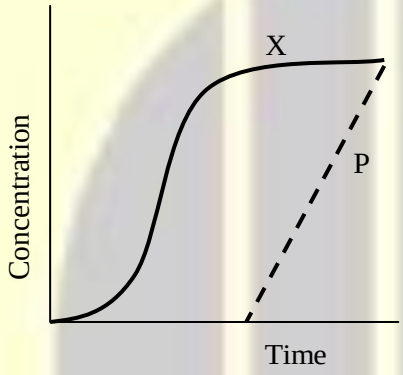
(A)



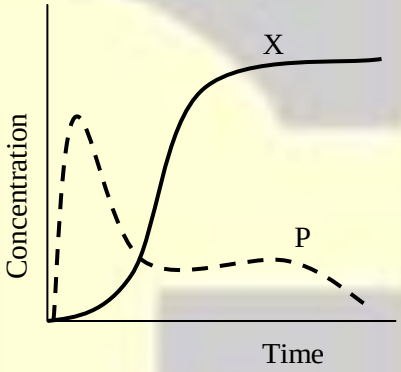

(B)




(C)




(D)




**Answer: (C)** **Click here to watch video explanation**

**17.** Which one the following techniques/tools is NOT used for inserting a foreign gene into a cell?

(A) Electroporation
(B) DNA microarray
(C) Microinjection
(D) Gene gun

**Answer: (B)** **Click here to watch video explanation**

**18.** A system consists of two reactors, connected by a valve. The first reactor (R1) contains an ideal gas A of volume 5L and the second reactor (R2) has an ideal gas B of volume 10 L. Initially, the valve is closed and pressure P in R1 and R2 are 9 and 6 atm, respectively. Later, when the valve is opened, the system reaches equilibrium. If the temperature T of both the reactors is maintained constant, the final equilibrium pressure in atm of the system is _____.

**Answer: (7)** **Click here to watch video explanation**

**19.** The sum of infinite geometric series $1+\frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+...$ (rounded off to one decimal place) is _____.

**Answer: (1.5)** **Click here to watch video explanation**

**20.** The process by which intracellular macromolecules are supplied for lysosomal degradation during nutrient starvation is

(A) pinocytosis (B) apoptosis (C) autophagy (D) phagocytosis

**Answer: (C)** **Click here to watch video explanation**

**21.** Which of the following layer(s) is/are formed from the inner cell mass of the blastocyst?

(A) Ectoderm (B) Mesoderm (C) Endoderm (D) Trophectoderm

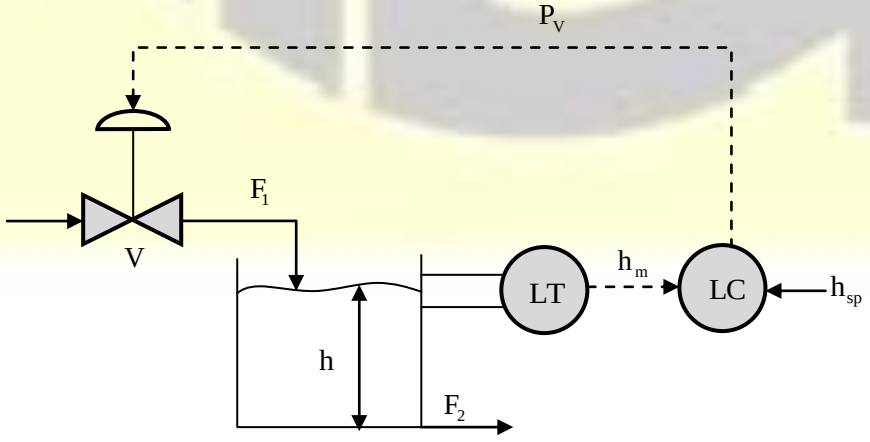
**Answer: (A, B, C)** **Click here to watch video explanation**

**22.** Number of unrooted trees in phylogeny of five sequences is

(A) 105 (B) 15 (C) 3 (D) 945

**Answer: (B)** **Click here to watch video explanation**

**23.** The process and instrumentation diagram for a feedback control strategy to maintain the level (h) of a liquid by regulating a valve (V) in a tank is shown below. $F_1$ is inlet liquid flow rate, $F_2$ is outlet liquid flow rate, LT is the liquid level transmitter, LC is the liquid level controller, $h_{sp}$ is the setpoint value of the liquid level, $h_m$ is the measured value of the liquid level and $P_V$ is the valve pressure.



The manipulating variable(s) is/are

(A) $F_2$ only

(B) $h_{sp}$ and $P_V$ only

(C) $h_m$ and $P_V$ only

(D) $F_1$ only

**Answer: (D)** **Click here to watch video explanation**

**24.** The cellular process which utilizes RNA-induced silencing complex to block gene expression is

(A) RNA interference

(B) RNA polyadenylation

(C) RNA splicing

(D) RNA editing

**Answer: (A)** **Click here to watch video explanation**

**25.** The enzyme that transcribes the eukaryotic genes encoding precursor ribosomal RNAs (pre-rRNAs) of 28S, 18S and 5.85S rRNAs is

(A) RNA polymerase IV

(B) RNA polymerase III

(C) RNA polymerase I

(D) RNA polymerase II

**Answer: (C)** **Click here to watch video explanation**

## Q. No. 26 to 55 Carry One Mark Each

**26.** Which one of the following is CORRECT about microbial growth medium?

(A) Luria-Bertani broth is a synthetic medium

(B) Nutrient broth is a defined medium

(C) Sabouraud dextrose agar is a differential medium

(D) Trypticase soy agar is a complex medium

**Answer: (D)** **Click here to watch video explanation**

**27.** Which of the following chemical messenger(s) is/are derivative(s) of tryptophan?

(A) Melatonin

(B) Serotonin

(C) Indole acetic acid

(D) γ-amino butyric acid

**Answer: (A, B, C)** **Click here to watch video explanation**

**28.** In a chemostat with a dilution rate of 0.8 $h^{-1}$, the steady state biomass concentration and the specific product formation rate are 8 mol $m^{-3}$ and 0.2 (mol product) $(\text{mole biomass})^{-1}h^{-1}$, respectively. The steady state product concentration in mol $m^{-3}$ is _____.

**Answer: (2)** **Click here to watch video explanation**

**29.** Which one of the following tools is used to compare all the possible six-open reading frames of a given nucleotide query sequence with all the available six open reading frames of the nucleotide sequence database?

(A) TBLASTN (B) TBLASTX (C) BLASTN (D) BLASTX

**Answer: (B)** **Click here to watch video explanation**

**30.** In Neurospora crassa, a mutation in the poky gene results in a slow growth phenotype (poky). The results of four crosses are given below.

**1.** wild-type ♀ × wild-type ♂ → All progeny are wild-type

**2.** wild-type ♀ × poky ♂ → All progeny are wild-type

**3.** poky ♀ × wild-type ♂ → All progeny are poky

**4.** poky ♀ × poky ♂ → All progeny are poky

Which one of the following explains the inheritance mode of poky?

(A) Episomal inheritance (B) X-linked inheritance

(C) Mendelian inheritance (D) Mitochondrial inheritance

**Answer: (D)** **Click here to watch video explanation**

**31.** Match enzymes in Group-I with their corresponding industrial application in Group-II.

| Group-I | Group-II |
|---|---|
| **P.** Amylase | **1.** Laundry detergent |
| **Q.** Invertase | **2.** Fruit juice clarification |
| **R.** Pectinase | **3.** Liquefaction of sucrose |
| **S.** Xylanase | **4.** Pulp and paper processing |

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

**Answer: (D)** **Click here to watch video explanation**

**32.** In a random mating population, Y and y are dominant and recessive alleles, respectively. If the frequency of Y allele in both sperm and egg is 0.70, then the frequency of Y/y heterozygotes (rounded off to two decimal places) is _____.

**Answer: (0.42)** **Click here to watch video explanation**

**33.** Which of the following nucleus/nuclei is/are NMR active?

(A) $^{32}S$ (B) $^{13}C$ (C) $^{16}O$ (D) $^{1}H$

**Answer: (B, D)** **Click here to watch video explanation**

**34.** A DNA solution of 50 $\mu g mL^{-1}$ concentration gives an absorbance of 1.0 at 260nm. An aliquot of 20 $\mu L$ from a 50 $\mu L$ purified plasmid solution is diluted with distilled water to a total volume of 1000 $\mu L$. The diluted plasmid solution gives an absorbance of 0.550 at 260nm. The concentration of the purified plasmid in $\mu g\ \mu L^{-1}$ (rounded off to two decimal places) is _____.

**Answer: (1.37)** **Click here to watch video explanation**

**35.** Calculate the following integral

$$\int_0^{\pi^2/4} \sin\sqrt{x}\, dx = \_\_\_\_\_.$$

**Answer: (2)** **Click here to watch video explanation**

**36.** Which of the following statement (s) is/are CORRECT about Agrobacterium tumefaciens?

(A) It causes crown gall disease in dicotyledonous plants
(B) It is Gram-positive soil bacterium
(C) It is used in generating transgenic plants
(D) It contains tumor inducing plasmid

**Answer: (A, C, D)** **Click here to watch video explanation**

**37.** The specific growth rate of a mold during exponential phase of its growth in a batch cultivations is 0.15 $h^{-1}$. If the cell concentration at 30h is 33 $gL^{-1}$, the cell concentration in $gL^{-1}$ (rounded off to the nearest integer) at 24 h is _____.

**Answer: (13.43)** **Click here to watch video explanation**

**38.** Match separation methods in Group-I with associated properties in Group-II.

| Group-I | Group-II |
|---|---|
| **P.** Centrifugation | **1.** Density |
| **Q.** Dialysis | **2.** Diffusivity |
| **R.** Solvent extraction | **3.** Size |
| **S.** Ultrafiltration | **4.** Solubility |

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

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

**Answer: (B)** **Click here to watch video explanation**

**39.** Which of the following antimicrobial agent (s) is/are growth factor analog(s)?

(A) Isoniazid (B) 5-Fluorouracil (C) Tetracycline (D) Sulfanilamide

**Answer: (A, B, D)** **Click here to watch video explanation**

**40.** A bacterium produces acetic from ethanol as per the following reaction

$$2CH_3CH_2OH + 2O_2 \rightarrow 2CH_3COOH + 2H_2O$$

The thermodynamic maximum yield of acetic acid from ethanol in $gg^{-1}$ (round off to two decimal places) is _____.

**Answer: (B)** **Click here to watch video explanation**

**41.** Match the autoimmune diseases in Group-I with the corresponding primarily affected organ in Group-II.

| Group-I | Group-II |
|---|---|
| **P.** Hashimoto's disease | **1.** Brain |
| **Q.** Juvenile diabetes | **2.** Pancreas |
| **R.** Multiple sclerosis | **3.** Skeletal muscle |
| **S.** Myasthenia gravis | **4.** Thyroid |

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

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

**Answer: (B)** **Click here to watch video explanation**

**42.** A 0.1 mL aliquot of a bacteriophage stock having a concentration of $4\times10^{9}$ phages $mL^{-1}$ is added to 0.5 mL of E.coli culture having a concentration of $2\times10^{8}$ cells $mL^{-1}$. The multiplicity of infection is _____.

**Answer: (4)** **Click here to watch video explanation**

**43.** Match hypersensitivity types in Group-I with their corresponding condition in Group-II.

| Group-I | Group-II |
|---|---|
| **P.** Type-I | **1.** Erythroblastosis fetalis |
| **Q.** Type-II | **2.** Host reaction to bee venom |
| **R.** Type III | **3.** Systemic lupus erythematosus |
| **S.** Type IV | **4.** Tuberculin reaction |

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

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

**Answer: (B)** **Click here to watch video explanation**

**44.** Which of the following combinations of plant hormones and their associated Function are CORRECT?

| Hormone | Function |
|---|---|
| P. Abscisic acid | Breaks seed dormancy |
| Q. Auxin | Induces cell division |
| R. Ethylene | Stimulates ripening of fruits |
| S. Gibberellin | Promotes seed dormancy |

(A) P and R only (B) Q and R only

(C) P and S only (D) Q and S only

**Answer: (B)** **Click here to watch video explanation**

**45.** If the values of two random variables (X, Y) are (121, 360), (242, 364) and (363, 362), the value of correlation coefficient between X and Y (rounded off to one decimal place) is _____.

**Answer: (0.5)** **Click here to watch video explanation**

**46.** In a Mendel's dihybrid experiment, a homozygous pea plant with round yellow seeds was crossed with a homozygous plant with wrinkled green seeds. $F_1$ intercross produced 560 $F_2$ progeny. The number of $F_2$ progeny having both dominant traits (round and yellow) is _____.

**Answer: (315)** **Click here to watch video explanation**

**47.** If the area of a triangle with the vertices (k, 0), (2, 0) and (0, –2) is 2 square units, the value of k is _____.

**Answer: (0, 4)** **Click here to watch video explanation**

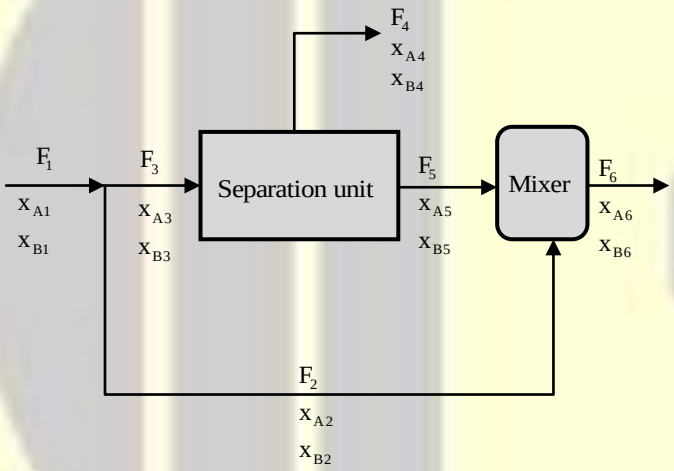
**48.** Milk flowing through a stainless steel inner tube (40 mm inner diameter) of double tube-type heater is to be heated from 10°C to 85°C by saturated steam condensing at 120°C on the outer surface of the inner tube. Total heat transferred (Q) is 146200 kcal $h^{-1}$ and the overall heat transfer coefficient is 750 kcal $h^{-1}m^{-2^{\circ}}C^{-1}$. The total length of the heating tube in m (rounded off to one decimal place) is _____.

**Answer: (23.69)** **Click here to watch video explanation**

**49.** A batch cultivation of E.coli follows zeroth order Mono's growth kinetics. The cell growth is terminated when the residual dissolved oxygen concentration attains 10% of its saturation value and oxygen mass transfer coefficient $\left(k_L a\right)$ reaches its maximum value $\left(80\,h^{-1}\right)$. The saturation value of dissolved oxygen concentration is 0.007 $kg\,m^{-3}$. If the maximum specific growth rate and yield coefficient $\left(Y_{X/O_2}\right)$ are 0.2 $h^{-1}$ and $1.5\left(kg\ cells\right)\left(kg\ O_2\right)^{-1}$, respectively, then the final cell concentration in $kg\,m^{-3}$ (rounded off to two decimal places) at the end of the batch cultivation is _____.

**Answer: (3.78)** **Click here to watch video explanation**

**50.** A feed stream $\left(F_1\right)$ containing components A and B is processed in a system comprising of separation unit and a mixer as shown below in the schematic diagram. The mole fractions of the components A and B are $x_A$ and $x_B$, respectively. If $F_1 + F_2 = 100\ kg\,h^{-1}$, the degrees of freedom of the system is _____.




**Answer: (6)** **Click here to watch video explanation**

**51.** It is desired to scale-up a fermentation from 1L to 1000L vessel by maintaining a constant power-to-volume ratio. The small fermenter is operated at an agitator speed of 300 rotations per minute (rpm). If the value of scale up factor is 10, agitator speed in rpm (rounded off to the nearest integer) for the large fermenter is _____.

**Answer: (64.5)** **Click here to watch video explanation**

**52.** The possible number of SalI restriction sites in a 9 kb double-standard DNA, with all four bases occurring in equal proportion (rounded off to the nearest integer) is _____.

**Answer: (2)** **Click here to watch video explanation**

**53.** Tertiary structure of a protein consisting of $\alpha$-helices and $\beta$-strands can be determined by

(A) nuclear magnetic resonance spectroscopy
(B) circular dichroism spectroscopy
(C) UV spectroscopy
(D) mass spectrometry

**Answer: (A)** **Click here to watch video explanation**

**54.** A sedimentation tank of height 100 cm is used in a conventional activated sludge process to separate a suspension of spherical shaped granular sludge biomass of 0.5 mm diameter. The viscosity of the liquid is 1 cP. The difference in density between the suspended biomass and the liquid is 0.1 $gcm^{-3}$. If the biomass reach their terminal velocity instantaneously, the biomass settling time in min(rounded off to two decimal places) is _____.

**Answer: (1.22)** **Click here to watch video explanation**

**55.** The determinant of matrix $A = \begin{pmatrix} 1 & 1 & 1 & 1 \\ -1 & 1 & 1 & 1 \\ -1 & -1 & 1 & 1 \\ 1 & 1 & 1 & 3 \end{pmatrix}$ is _____.

**Answer: (8)** **Click here to watch video explanation**