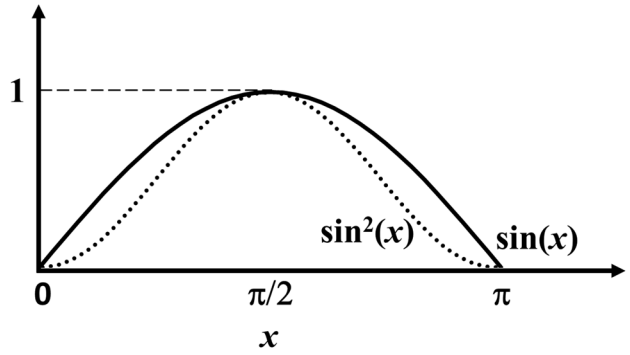
Section A: Q.1 – Q.10 Carry ONE mark each.	
Q.1	The most abundant phospholipid in *E.coli* plasma membrane is
(A)	phosphatidyl ethanolamine
(B)	phosphatidyl choline
(C)	phosphatidyl serine
(D)	phosphatidyl inositol
Q.2	If $y(x) = 15\cos(x) - 13\sin(x)$, then $\frac{d^2y}{dx^2}$ will be
(A)	2
(B)	$\frac{\pi}{y}$
(C)	$-y$
(D)	$\frac{y^2}{x}$

Q.3	Which one of the following is **NOT** a second messenger in mammalian cells?
(A)	Cyclic AMP
(B)	Diacyl glycerol
(C)	Calcium ion
(D)	Potassium ion
Q.4	Which one of the following is the correct decreasing order for the magnitude of Electron Gain Enthalpy ($\Delta E_{eg}H$) for the elements given below?
(A)	$Br > Cl > At > I$
(B)	$Cl > Br > I > At$
(C)	$I > Br > Cl > At$
(D)	$At > Br > Cl > I$

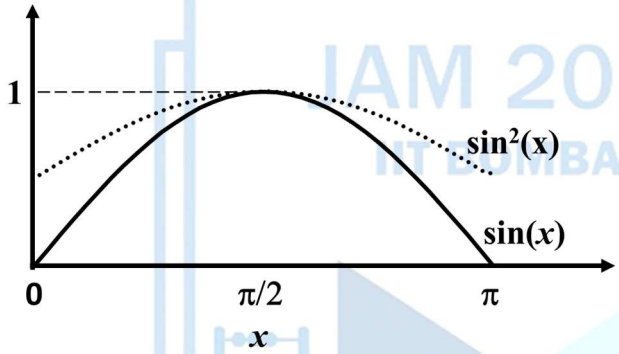
Q.5	Coenzyme A is a co-factor of vitamin
(A)	riboflavin
(B)	pantothenic acid
(C)	folic acid
(D)	pyridoxine

Q.6 Which one of the following is the correct graphical representation for functions, $\sin(x)$ and $\sin^2(x)$ for $0 \leq x \leq \pi$?

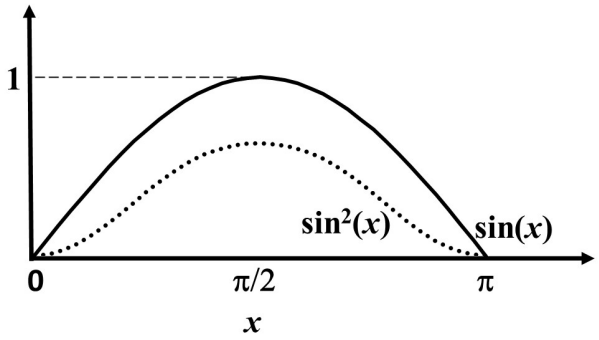
(A)



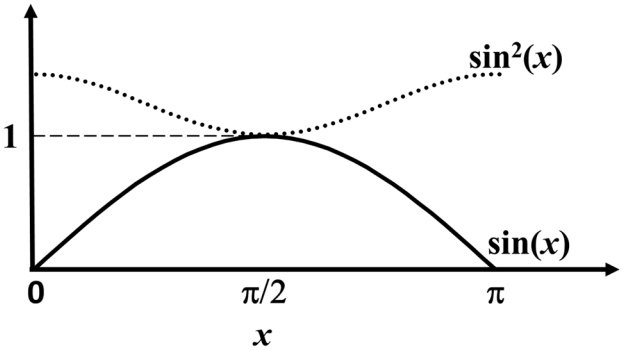
(B)



(C)



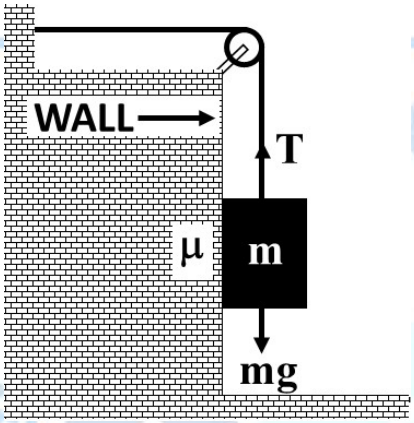
(D)



Q.7	Which one of the following is **NOT** an essential amino acid?
(A)	Threonine
(B)	Tryptophan
(C)	Tyrosine
(D)	Valine
Q.8	Which one of the following classes of membrane protein requires ATP for transport of some specific ions or molecules across the cellular membranes?
(A)	Ion channels
(B)	Pumps
(C)	Symporters
(D)	Antiporters

Q.9	The derivative of $x \log_e(x)$ is
(A)	1
(B)	0
(C)	e^x
(D)	$1+ \log_e(x)$
Q.10	Which one of the following processes causes the 'Founder effect' in a population?
(A)	Genetic drift
(B)	Mutations
(C)	Natural selection
(D)	Genetic recombination

Section A: Q.11 – Q.30 Carry TWO marks each.	
Q.11	The repulsive interaction between different types of electron pairs increases in the order of
(A)	bond pair - bond pair < lone pair - bond pair < lone pair - lone pair
(B)	lone pair - lone pair < lone pair - bond pair < bond pair - bond pair
(C)	lone pair - bond pair < lone pair - lone pair < bond pair - bond pair
(D)	lone pair - lone pair < bond pair - bond pair < lone pair - bond pair

Q.12	Consider a block of mass ‘m’ hanging using a string and pulley arrangement, as shown in the figure. The weight ‘mg’ and tension ‘T’ are working on the block in such a way that the block is not moving and the string is parallel to the perfectly vertical wall. If the block is just in contact (but not attached/fixed) with the wall and the coefficient of static friction is ‘μ’, then the static frictional force acting on the block is 
(A)	0
(B)	μmg
(C)	μT
(D)	$\mu \frac{(mg+T)}{2}$

Q.13	Which one of the following vector types is suitable to clone 2000 kb DNA insert?
(A)	Bacterial plasmid
(B)	Bacteriophage
(C)	Cosmid
(D)	Yeast artificial chromosome
Q.14	In the genetic code, 61 codons code for 20 amino acids. How many types of aminoacyl tRNA synthetases are required for correct matching of tRNAs to their corresponding amino acids?
(A)	61
(B)	64
(C)	40
(D)	20

Q.15	The correct gas phase acidity order for alcohols FCH_2OH, CH_3OH, $ClCH_2OH$ and $BrCH_2OH$ is
(A)	$ClCH_2OH > BrCH_2OH > CH_3OH > FCH_2OH$
(B)	$FCH_2OH > BrCH_2OH > ClCH_2OH > CH_3OH$
(C)	$CH_3OH > FCH_2OH > BrCH_2OH > ClCH_2OH$
(D)	$ClCH_2OH > BrCH_2OH > FCH_2OH > CH_3OH$
Q.16	Which one of the following statements is **NOT** correct?
(A)	In the Northern Hemisphere many mammals hibernate in winter
(B)	The vegetation in Tundra is predominantly herbaceous
(C)	The dominant trees in the Northern Hemisphere are deciduous
(D)	Average temperature in Tundra is above 30 °C

Q.17	Which one of the following is a characteristic of apoptosis?
(A)	Endocytosis
(B)	Uncontrolled cell proliferation
(C)	DNA fragmentation
(D)	Cell migration
Q.18	Which one of the following is **NOT** an auxin?
(A)	Indole-3-acetic acid
(B)	Abscisic acid
(C)	Phenylacetic acid
(D)	Indole-3-butyric acid

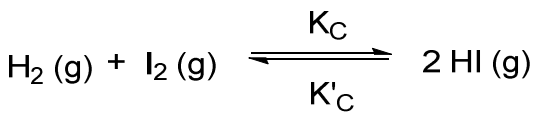
Q.19	Which one of the following bonds is formed at the branch point in glycogen?
(A)	α-1, 4 glycosidic bond
(B)	α-1, 6 glycosidic bond
(C)	β-1, 4 glycosidic bond
(D)	β-1, 6 glycosidic bond
Q.20	Identify the **INCORRECT** statement about the immunoglobulins (Ig)
(A)	IgM forms pentamer
(B)	IgA forms dimer
(C)	IgD is the most abundant immunoglobulin
(D)	IgE is associated with allergic reactions

Q.21	Bacterial conjugation
(A)	occurs through the uptake of free DNA from environment
(B)	requires direct contact between two bacterial cells through pilus
(C)	involves the transfer of genetic material from virus to bacteria
(D)	is a form of asexual reproduction
Q.22	If a simple pendulum has length l and time period T then a pendulum of length $2l$ will have a time period of
(A)	$2\pi T$
(B)	$\frac{1}{2\pi}T$
(C)	$\sqrt{2}T$
(D)	$\frac{1}{\sqrt{2}}T$

Q.23	Which one of the following characteristics is **ABSENT** in Archaea?
(A)	Pseudomurein
(B)	Paracrystalline surface layer (S-layer)
(C)	Peptidoglycan
(D)	Circular chromosome

Q.24	Identify the correct match between the vitamins and their deficiency symptoms **Vitamins** **Symptoms** (i) Vitamin A (p) Night blindness (ii) Vitamin D (q) Anemia (iii) Vitamin B6 (r) Bone softening (iv) Vitamin C (s) Delayed wound healing (v) Vitamin K (t) Prolonged bleeding
(A)	(i) – (p), (ii) – (q), (iii) – (r), (iv) – (t), (v) – (s)
(B)	(i) – (p), (ii) – (r), (iii) – (q), (iv) – (s), (v) – (t)
(C)	(i) – (q), (ii) – (p), (iii) – (r), (iv) – (s), (v) – (t)
(D)	(i) – (p), (ii) – (q), (iii) – (t), (iv) – (r), (v) – (s)

Q.25	In the context of the nitrogen cycle in plants, identify the correct match between the nitrogen compound and the oxidation state of nitrogen Nitrogen compound — Oxidation state of nitrogen (i) N_2 — (p) +1 (ii) NO — (q) +4 (iii) N_2O — (r) 0 (iv) NO_2 — (s) +2
(A)	(i) – (s)
(B)	(ii) – (p)
(C)	(iii) – (r)
(D)	(iv) – (q)

Q.26	The correct relation between equilibrium constants, K_C (forward direction) and K'_C (reverse direction) of the reaction given below, at the same temperature, is 
(A)	$K_C = K'_C$
(B)	$K_C = \frac{1}{K'_C}$
(C)	$K_C = -K'_C$
(D)	$K_C = \sqrt{K'_C}$

Q.27	Consider the differential equation $\frac{dy}{dx} + 4x = 0$. The solution of this equation for the particular case of $y = 1$, at $x = 0$ is
(A)	$y = 4x$
(B)	$y = -4x^2 + 1$
(C)	$y = 1 - 2x^2$
(D)	$y = \log(x) + 4x$
Q.28	Which one of the following animal viruses contains double stranded RNA as genetic material?
(A)	Influenza virus
(B)	Rous sarcoma virus
(C)	Polio virus
(D)	Reovirus

Q.29	Which one of the following σ (sigma) factors is responsible for the transcriptional regulation of nitrogen assimilation?
(A)	σ 70
(B)	σ 54
(C)	σ 28
(D)	σ 24
Q.30	Which one of the following statements regarding plant Photosystems is **NOT** true?
(A)	Photosystem I is present in unstacked thylakoid membrane
(B)	Photosystem II is present in stacked thylakoid membrane
(C)	Photosystem I absorbs light of 700 nm wavelength
(D)	Photosystem I is responsible for water splitting

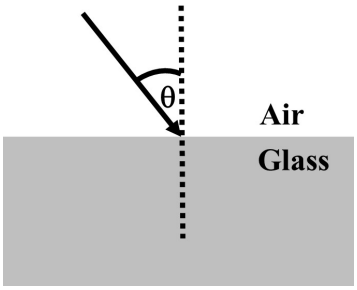
Section B: Q.31 – Q.40 Carry TWO marks each.	
Q.31	Which of the following is/are true for the data given below? 15, 8, 10, 6, 11, 9, 15, 7, 14, 5, 17, 14, 8, 14, 12
(A)	Median is 11
(B)	Mode is 11
(C)	Median is 14
(D)	Mode is 14

Q.32	Which of the following is/are present in the human brain?
(A)	Astrocytes
(B)	Podocytes
(C)	Oligodendrocytes
(D)	Microglial cells
Q.33	Which of the following statements is/are true about phenoxide ions?
(A)	Phenoxides undergo O-alkylation in ethers
(B)	Phenoxides undergo extensive C-alkylation in trifluoroethanol
(C)	Ethers make strong hydrogen bonds with the oxygen atom of phenoxide ions to improve solvation
(D)	C-alkylation disrupts aromatic conjugation of phenoxide ions

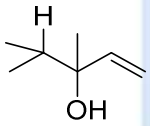
Q.34	Select the value(s) of x for which the determinants, $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix}$ and $\begin{vmatrix} 2x & 6 \\ 4 & x \end{vmatrix}$ are equal
(A)	$\sqrt{3}$
(B)	3
(C)	-1
(D)	$-\sqrt{3}$
Q.35	The capacitance of a parallel plate capacitor will get doubled if
(A)	the area of each plate is doubled
(B)	the area of each plate is halved
(C)	the distance between the plates is doubled
(D)	the distance between the plates is halved

Q.36	In a protein, trypsin catalyzes the hydrolysis of peptide bonds with carbonyl group contributed by
(A)	glutamine
(B)	asparagine
(C)	lysine
(D)	arginine
Q.37	In circular dichroism (CD) spectroscopy, the difference in molar extinction coefficients ($\Delta\varepsilon$) is plotted as a function of wavelength λ (in nm). In a CD spectrum of an alpha helical protein, $\Delta\varepsilon$ will have a
(A)	negative value at 210 nm
(B)	positive value at 195 nm
(C)	negative value at 220 nm
(D)	negative value at 195 nm

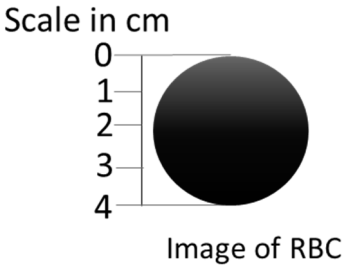
Q.38	Which of the following statements is/are true for sterilization?
(A)	Autoclaving at 121 °C for 20 minutes destroys endospores
(B)	Filtration through 0.22 μm membrane removes viruses from liquid
(C)	Dry heat sterilization requires higher temperature and longer time than moist heat sterilization
(D)	Gamma radiation sterilizes heat-sensitive medical equipment

Q.39	If a light beam (solid arrow in the shown figure) is entering from Air medium to Glass medium (having refractive index of 1.5), then while entering 
(A)	speed of light will decrease
(B)	speed of light will increase
(C)	light will bend (deviate from original path) if $\theta \neq 0$
(D)	light will undergo total internal reflection
Q.40	Which of the following methods is/are used for local alignment of nucleotide sequences?
(A)	Smith-Waterman algorithm
(B)	Needleman-Wunsch algorithm
(C)	BLAST
(D)	Neighbour-joining method

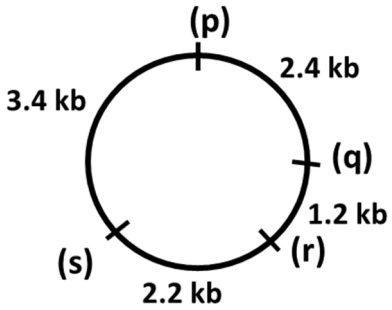
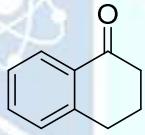
Section C: Q.41 – Q.50 Carry ONE mark each.	
Q.41	Consider that M, L, and T indicate mass, length and time, respectively. If $[ML^2T^{-n}]$ is the dimensional formula for the physical quantity Torque, then the value of n is _____. (in integer)
Q.42	The volume of 4M NaOH (in ml) required to make 350 ml solution of 1.2M NaOH is _____. (in integer)
Q.43	The nucleotide sequence of one of the DNA strands is GCTGTAACGATAGCACGC. The GC content (in %) of the double stranded DNA will be _____. (round off to two decimal places)

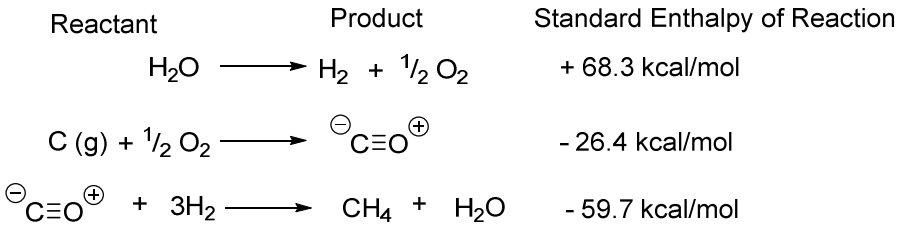
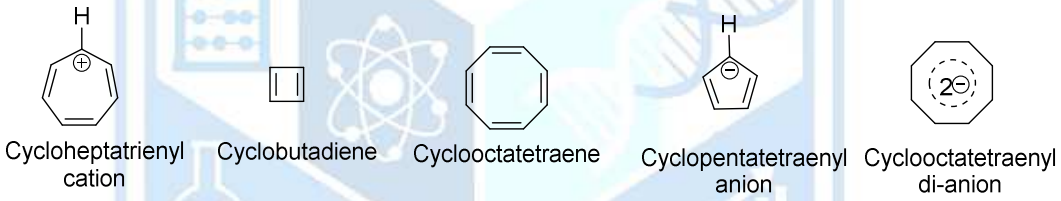
Q.44	In a geometric progression, the 3rd term is 36 and the 5th term is 324. The 7th term of the same progression will be _____. (in integer)
Q.45	A ball is thrown vertically upward with a speed of 19.6 m/s. The value of acceleration due to gravity at that place is 9.8 m/s^2. The maximum height (in cm) that the ball reaches is _____ . (in integer)
Q.46	The number of double bonds present in the isohypsic transformation product of allylic alcohol (Z) is _____. (in integer)  allylic alcohol (Z)

Q.47	The value of $\lim_{x\to 3} \frac{x^3-3x^2}{x^2-5x+6}$ is _____. (in integer)
Q.48	A photon has energy of 3.1×10^{-19} J. Its wavelength (in Å) is _____. (round off to one decimal place) (Consider Planck's constant, h = 6.6×10^{-34} J s; speed of light in vacuum, c = 3×10^{10} cm/s)
Q.49	Assuming atomic mass number of *C* = 12, *N* = 14, *O* = 16, *H* = 1, the molecular mass (in Daltons) of a tripeptide made up of only glycine amino acids is _____. (in integer)

Q.50	If the real diameter of an RBC is 8 μm, then the magnification of its image given below is _____. (in integer) 
Section C: Q.51 – Q.60 Carry TWO marks each.	
Q.51	Consider an ATP synthase having twelve C-rings to sense proton motive force. The average number of protons required per ATP synthesis is _____. (in integer)
Q.52	A particular animal population has 4400 individuals with annual per capita birth rate of 0.035 and the annual per capita death rate of 0.02. Net change in the population size in a year will be _____. (in integer)

Q.53	During anaerobic glycolysis in muscle, each mole of glucose is converted into two moles of lactate, yielding two moles of ATP. Assume molar mass of glucose is 180 g/mol. If 1 kg of glucose undergoes complete conversion to lactate, the number of moles of ATP produced is _____. (round off to one decimal place)
Q.54	Consider a spherical epithelial cell (C1) of diameter 20 μm and a cubic shaped liver cell (C2) of side 20 μm. The ratio of the surface areas of C1 : C2 is _____. (round off to two decimal places)
Q.55	If a weak acid HA is 0.1% ionized (dissociated) in a 0.2M solution, its pH will be _____. (round off to one decimal place)

Q.56	A 9.2 kb plasmid DNA shown below has four BamHI sites (p), (q), (r), (s). If a mutation results in the loss of BamHI site (r), assuming the complete digestion by BamHI, the number of DNA fragments seen in agarose gel after electrophoresis will be _____. (in integer) 
Q.57	The number of distinct products formed after the nitration of tetralone in the presence of HNO_3 and H_2SO_4 is _____. (in integer)  Tetralone

Q.58	The standard enthalpy of formation of methane (CH_4), using the standard enthalpy of reaction values from the following reaction steps, is $-x$ kcal/mol. The value of x is _____. (round off to one decimal place) 
Q.59	Applying the Hückel rule, the number of aromatic compounds among the following is _____. (in integer) 
Q.60	Consider that 120 cells of bacteria are inoculated in a nutrient rich media. If the doubling time of the bacteria is 20 minutes and assuming no cell death, the number of bacterial cells present after 2 hours will be_____. (in integer)

END OF THE QUESTION PAPER