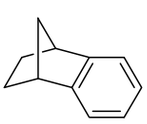
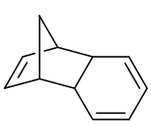
H: CHEMISTRY (COMPULSORY)

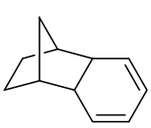
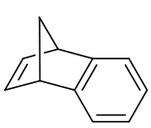
Q. 1 – Q. 5 carry one mark each.

Q.1 The molecule having net 'non-zero dipole moment' is

(A) CCl_4 (B) NF_3 (C) CO_2 (D) BCl_3

Q.2 The Diels-Alder adduct from the reaction between cyclopentadiene and benzyne is

(A)  (B) 

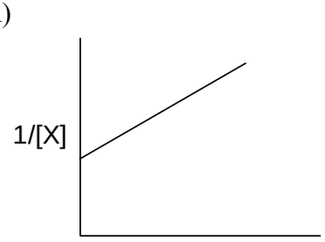
(C)  (D) 

Q.3 The number of possible enantiomeric pair(s) in HOOC−CH(OH)−CH(OH)−COOH is_____

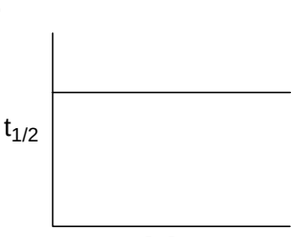
Q.4 For the electrochemical reaction, $Cu^{2+}(aq) + Zn(s) \rightleftharpoons Cu(s) + Zn^{2+}(aq)$ the equilibrium constant at 25 °C is 1.7×10^{37}. The change in standard Gibbs free energy (ΔG^o) for this reaction at that temperature will be _____ kJ mol^{-1} (up to one decimal place).
(**Given:** R = 8.314 $JK^{-1}mol^{-1}$)

Q.5 Among the following diagrams, the one that correctly describes a zero order reaction (X → product) is
(**Given:** $[X]_o$ = initial concentration of reactant X; [X] = concentration of reactant X at time *t* and $t_{1/2}$ = half-life period of reactant X)

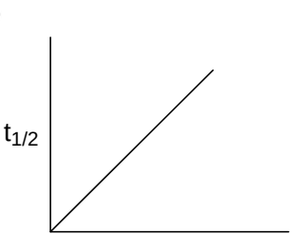
(A)



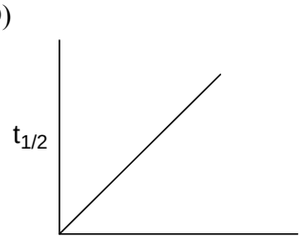
(B)



(C)



(D)



Q. 6 – Q. 15 carry two marks each.

Q.6 If the radius of first Bohr orbit is 0.53 Å, then the radius of the third Bohr orbit is

(A) 2.12 Å (B) 4.77 Å (C) 1.59 Å (D) 3.18 Å

Q.7 If 50 mL of 0.02 M HCl is added to 950 mL of H_2O, then the pH of the final solution will be_____

Q.8 Stability of $[CrCl_6]^{3-}$ (**X**), $[MnCl_6]^{3-}$ (**Y**) and $[FeCl_6]^{3-}$ (**Z**) follows the order
(**Given:** Atomic numbers of Cr = 24, Mn = 25 and Fe = 26)

(A) **X** > **Y** > **Z** (B) **X** < **Y** < **Z** (C) **Y** < **X** < **Z** (D) **X** < **Y** = **Z**

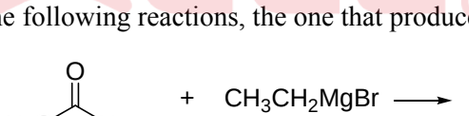
Q.9 Among the following pairs, the paramagnetic and diamagnetic species, respectively, are

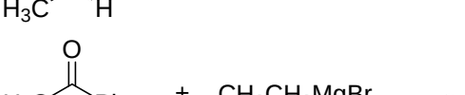
(A) CO and O_2^- (B) NO and CO (C) O_2^{2-} and CO (D) NO^+ and O_2^-

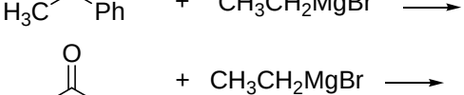
Q.10 In compounds $K_4[Fe(CN)_6]$ (**P**) and $Fe(CO)_5$ (**Q**), the iron metal centre is bonded to

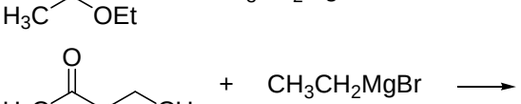
(A) C of CN^- in **P** and C of CO in **Q**
(B) N of CN^- in **P** and C of CO in **Q**
(C) C of CN^- in **P** and O of CO in **Q**
(D) N of CN^- in **P** and O of CO in **Q**

Q.11 Among the following reactions, the one that produces achiral alcohol (after hydrolysis) is

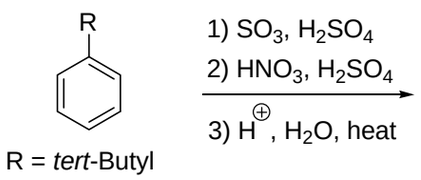
(A) 

(B) 

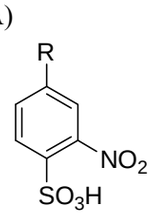
(C) 

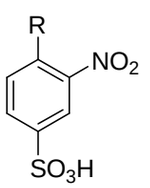
(D) 

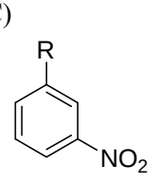
Q.12 The major product from the following reaction is

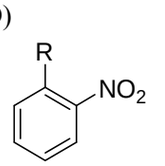


R = *tert*-Butyl

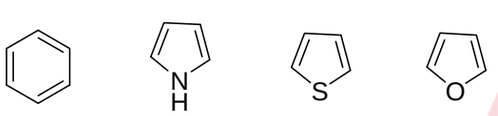
(A)


(B)


(C)


(D)


Q.13 The order of resonance energy for the following molecules is



(1) (2) (3) (4)

(A) (1) > (3) > (2) > (4)

(B) (1) > (3) > (4) > (2)

(C) (1) > (4) > (2) > (3)

(D) (1) > (4) > (3) > (2)

Q.14 The molar enthalpy of vaporization for a liquid (normal boiling point = 78.3 ^{o}C) is 39 kJ mol^{-1}. If the liquid has to boil at 25 ^{o}C, the pressure must be reduced to _____ Torr (up to one decimal place).

(**Given:** R = 8.314 JK^{-1}mol^{-1}; 1 atm = 760 Torr)

Q.15 For the process, $H_2O(l) \rightleftharpoons H_2O(s)$ at 0 ^{o}C and 1 atm, the correct statement is

(A) $\Delta S_{system} = 0$ (B) $\Delta S_{total} > 0$ (C) $\Delta S_{total} = 0$ (D) $\Delta S_{total} < 0$

END OF THE QUESTION PAPER

I : BIOCHEMISTRY

Q. 1 – Q. 10 carry one mark each.

Q.1 Which one of the following small molecules is a prerequisite for fatty acid oxidation?

(A) Inositol (B) Choline (C) Carnitine (D) Glycerol

Q.2 Which one of the following bases is **NOT** found in the T-arm of an aminoacyl t-RNA?

(A) Dihydrouridine
(B) Pseudouridine
(C) Uracil
(D) Guanine

Q.3 Oxidation of one molecule of glucose via the glycerol-phosphate shuttle produces

(A) 32 molecules of ATP (B) 32 molecules of NADPH
(C) 30 molecules of ATP (D) 30 molecules of NADPH

Q.4 Ribulose-5-phosphate epimerase is involved in which one of the following processes?

(A) Glycolysis
(B) TCA cycle
(C) Glycosylation
(D) Pentose phosphate pathway

Q.5 Proteolytic enzymes are usually biosynthesized as large, inactive precursors known as

(A) holoenzymes (B) ribozyme
(C) zymogens (D) apoenzymes

Q.6 The formation of a carbocation, also called an oxonium ion, occurs during the reaction catalyzed by

(A) aldolase (B) lysozyme (C) ribonuclease A (D)) carboxypeptidase

Q.7 Which one of the following amino acid substitutions is likely to cause the largest change in protein conformation?

(A) Phe Ile (B) Ser Thr (C) Gln Tyr (D) Glu Val

Q.8 Which one of the following does **NOT** constitute the lipid moiety in lipid-linked membrane proteins?

(A) Palmitic acid (B) Stearic acid
(C) Farnesyl groups (D) Myristic acid

Q.9 A closed circular B-DNA of 4000 base pairs is negatively supercoiled by introduction of 4 writhes. The super helical density of the resultant DNA molecule will be _____

Q.10 Which one of the following is **NOT** a receptor tyrosine kinase?

(A) Platelet derived growth factor receptor
(B) Insulin like growth factor - 1 receptor
(C) Macrophage colony stimulating factor receptor
(D) Transforming growth factor β receptor

Q. 11 – Q. 20 carry two marks each.

Q.11 Match the entries in Column-1 with those in Column-2

Column-1	**Column-2**
P. Vitamin B1	1. Thiamine pyrophosphate
Q. Carboxypeptidase	2. Aconitase
R. TCA cycle	3. Sucrose
S. Reducing sugar	4. Zn^{2+}
	5. Riboflavin
	6. Lactose

(A) P-1; Q-4; R-2; S-6
(B) P-5; Q-1; R-2; S-3
(C) P-1; Q-4; R-5; S-6
(D) P-5; Q-2; R-1; S-6

Q.12 The following table provides information about four proteins.

Protein	**Native mol. wt. (Da)**	**pI**	**Type**
P	32000	6.4	monomer
Q	40000	8.5	homodimer
R	25000	4.9	monomer
S	45000	8.5	homotrimer

Which one of the following options correctly identifies the order of elution in size exclusion chromatography and the increasing order of mobility in SDS polyacrylamide gel?

(A) Chromatography: **SQPR**; Electrophoresis: **RPQS**
(B) Chromatography: **RPQS**; Electrophoresis: **SQPR**
(C) Chromatography: **PRQS**; Electrophoresis: **PRQS**
(D) Chromatography: **SQPR**; Electrophoresis: **PRQS**

Q.13 The predicted molar extinction coefficient at 280 nm for the peptide **GEEFHISFLLIMFGAWSTHMYRTYWFIHEMISTRY** is _____ $M^{-1}cm^{-1}$.

[Molar extinction coefficients for phenylalanine, tryptophan and tyrosine at 280 nm are 200, 5600 and 1400 $M^{-1}cm^{-1}$, respectively]

Q.14 Match the contents of Column I with the most appropriate options in Column II

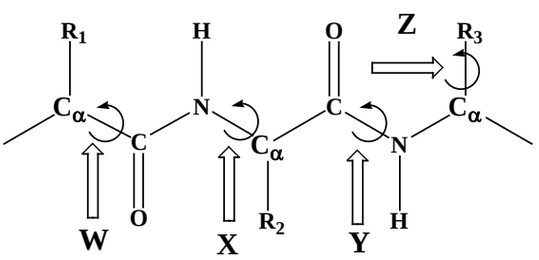
Column I	**Column II**
P. Complement C1q	i. CD34
Q. L-Selectin	ii. Complement C5b
R. Membrane Attack Complex	iii. Fc region of antibody
S. T-Helper cells	iv. Complement C5a
	v. CD40L

(A) P-iii ; Q-v ; R-iv ; S-i
(B) P-i ; Q-ii ; R-iv ; S-v
(C) P-iii ; Q-i ; R-ii ; S-v
(D) P-iv ; Q-v ; R-ii ; S-i

Q.15 The value of ΔG at 37 °C for the movement of Ca^{2+} ions from the endoplasmic reticulum where $[Ca^{2+}]$ is 1 mM to the cytosol where $[Ca^{2+}]$ is 0.1 μM at –50 mV membrane potential is _____ kJ mol^{-1} .

[R = 8.314 $JK^{-1}mol^{-1}$ and 1 Faraday = 96500 Coulombs]

Q.16



Column I	Column II
W	i. ψ
X	ii. χ
Y	iii. ϕ
Z	iv. ω

Which of the following identifies the correctly matched pairs?

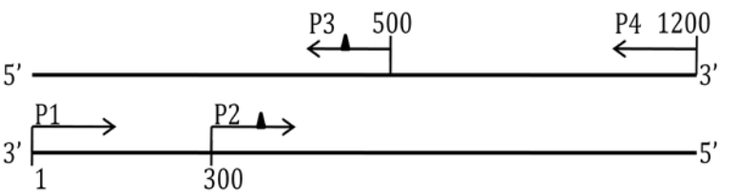
(A) W-iii ; X-i ; Y-iv ; Z-ii
(B) W-i ; X-iii ; Y-iv ; Z-ii
(C) W-i ; X-iii ; Y-ii ; Z-iv
(D) W-iii ; X-i ; Y-ii ; Z-iv

Q.17 Which of the following statements is/are **INCORRECT** about hemoglobin (Hb)?

I. Hb demonstrates higher oxygen carrying capacity compared to myoglobin
II. There is covalent bonding between the four subunits of Hb
III. During deoxygenation the loss of the first oxygen molecule from oxygenated Hb promotes the dissociation of oxygen from the other subunits

(A) II (B) II & III (C) I & III (D) III

Q.18 A 1.2 kb DNA fragment was used as a template for PCR amplification using primers P1, P2, P3 and P4 as shown in the scheme below. The annealing positions of primers on the template are indicated by numbers. Primers P2 and P3 contain single base mismatches as indicated by filled triangles.



PCR was performed using primer pair P1 and P3 in one vial and P2 and P4 in another vial. The purified PCR products from the two vials were mixed and subjected to another round of PCR with primers P1 and P4. The final PCR product will correspond to a

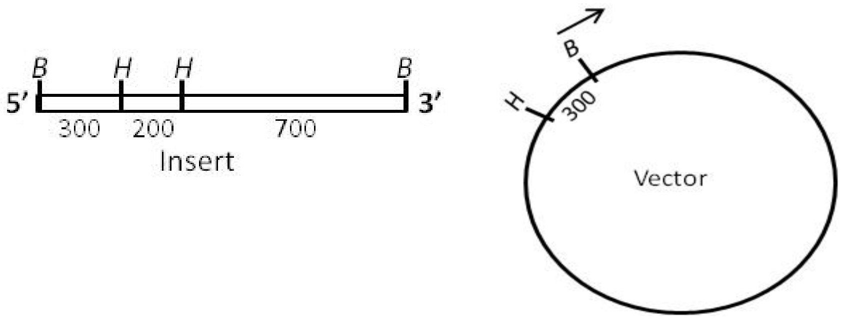
(A) 1.2 kb wild type DNA
(B) 1.2 kb DNA with two point mutations
(C) 0.9 kb DNA with one point mutation
(D) 0.5 kb DNA with one point mutation

Q.19 A cell suspension was subjected to membrane disruption followed by differential centrifugation to fractionate the cellular components.
Match the centrifugal conditions in Column I to the appropriate subcellular components in Column II.

Column I	**Column II**
P. 1000 g, 10 min	i. Microsomes and small vesicles
Q. 20000 g, 30 min	ii. Ribosomes
R. 80000 g, 1 hour	iii. Nuclei
S. 150000 g, 3 hours	iv. Lysosomes and peroxisomes

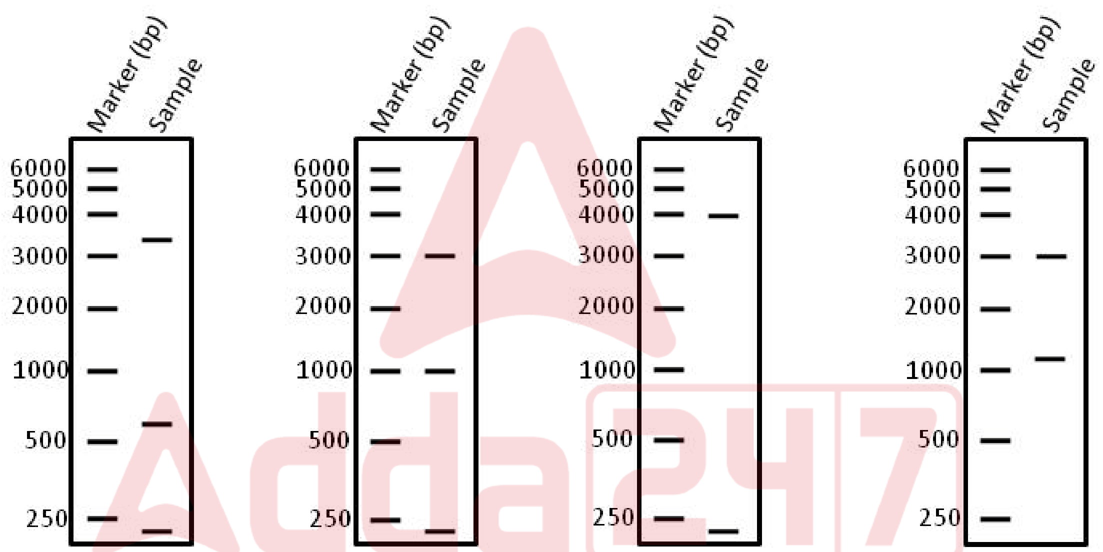
(A) P-iii ; Q-iv ; R-i ; S-ii
(B) P-i ; Q-iv ; R-iii ; S-ii
(C) P-iii ; Q-iv ; R-ii ; S-i
(D) P-ii ; Q-i ; R-iv ; S-iii

Q.20 Given below are the maps of a 1200 base pairs (bp) long DNA insert and a 3000 bp expression vector. The HindIII (H) and BamHI (B) restriction sites and DNA length between them are indicated in base pairs.



The insert is cloned into the vector at the BamHI site. Its orientation in the recombinant plasmid was confirmed by complete HindIII digestion followed by agarose gel electrophoresis. Which one of the following lanes would correspond to the correct orientation of the insert in the construct?

(A) (B) (C) (D)



END OF THE QUESTION PAPER

Q. 1 – Q. 10 carry one mark each.

Q.1 Nuclear membrane is absent in

(A) Chlamydomonas
(B) Nostoc
(C) Volvox
(D) Chlorella

Q.2 An organized and differentiated cell having cytoplasm but no nucleus is found in

(A) Companion cell
(B) Xylem parenchyma
(C) Sieve tube element
(D) Phloem parenchyma

Q.3 Double haploids in plants can be induced by

(A) Mitomycin-C
(B) Mirin
(C) Colchicine
(D) 5-Azac ytidine

Q.4 During fatty acid biosynthesis, the first intermediate malonyl-CoA is formed from

(A) Acetyl-CoA and bicarbonate
(B) Two acetyl-CoA molecules
(C) Acetyl-CoA and biotin
(D) Palmitoyl CoA and acyl-carrier protein (ACP)

Q.5 Which of the following techniques is NOT applicable for validating the expression of a transgene?

ern blot
CR
rn blot
ern blot

he family possessing the following characters: presence of glucosinolates, CORRECT
s, superior ovary with parietal placentation and siliqua type fruit

g reduces the transpiration rate when applied to aerial parts of plants?

etate

structure that forms the connection between the endoplasmic reticulum of
gh plasmodesmata is

(B) Desmosome (C) Dictyosome (D) Microtubule

Q.9 Which one of the following is NOT a cryoprotectant commonly used in plant tissue?

Dimethyl sulfoxide
Glycerol
Ethylene glycol
Liquid nitrogen

o similar holotypes are called

Monotype (B) Neotype (C) Isotype (D) Syntype

) carry two marks each.

Q.11 A cross was made between AABBCCDDEE and aabbccddee. The resultants F_1 were selfed. Applying Mendelian principles, the proportion of PROGENY showing all the recessive characters in F_2 generation.

(A) (B) (C) (D)

ntify the INCORRECT statements with respect to functioning of ecosystem.

is a series of organisms, each one feeding on the organism succeeding it
esents a complete picture of the feeding relationships in any given ecosystem
, energy flows in unidirectional way, whereas nutrients flow in cyclic fashion
mical cycles, nutrients do not alternate between organisms and environment

(B) P, R (C) R, S (D) Q, R

e of the diseases with their causal organisms.

Causal Organism

pora personata

Q.14 Match the plant products with their sources and the plant parts from which they are obtained.

Product	Source	Plant part
i. Seed	d. Acacia catechu	

$_4$ cycle?

P. Stomata open during night and remain closed during the day
Q. PEPcase is the carboxylating enzyme to form C_4 acid
R. C_4 acid is decarboxylated to provide CO_2 for C_3 cycle
S. Kranz anatomy is predominant in both CAM and C_4 plants

(A) P, S (B) Q, R (C) P, Q (D) R, S

Q. 18 With respect to germination of seeds, the CORRECT sequence of events is

P. Seed imbibes water
Q. Mobilization of starch reserve to embryo
R. Diffusion of gibberellin from embryo to aleurone layer
S. Synthesis of α-amylase in the aleurone layer

(A) P, Q, S, R
(B) P, R, S, Q
(C) R, P, Q, S
(D) R, Q, P, S

19 Identify the CORRECT statements with regard to the function of plant hormones

sized from chorismate and promotes viviparous germination
acidification of cell wall followed by turgour-induced cell expansion
ponsive genes become activated by the repression of DELLA protein
lates the G_2 to M transition in the cell cycle

(A) P, Q (B) Q, R (C) Q, S (D) P, R

Q.20 Statements (P-S) given below are either TRUE (T) or FALSE (F). Find the correct combination.

unipolar in nature
be selected using a fluorescence-activated cell sorter (FACS)
nal variation is coined by Larkin and Scowcroft
shoot buds during organogenesis

, R-F, S-T
, R-T, S-F

K: MICROBIOLOGY

Q. 1 – Q. 10 carry one mark each.

Q.1

(A)

(B)

(C)

(D)

Q.

(A) (B) (C) (D)

Q.

(A) (B)

(C) β

(A) (B) (C) (D)

Q. **Group I with terms related to their major scientific contributions. Group II**

Group I	Group II
(I)	(P)
(II)	(Q)
(III)	(R)
(IV)	(S)

Q.

(A) (B) (C) (D)

Q. **ASCENDING ORDER is**

(A) genus, species, class, order, family (B) species, genus, order, family, class

(C) species, genus, family, order, class (D) genus, species, order, class, family

(A)

(B)

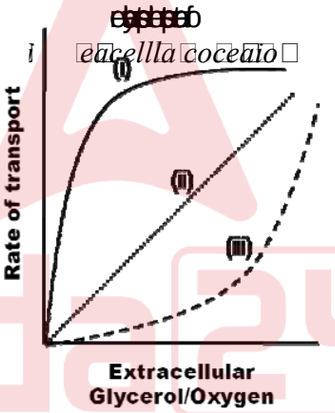
(C)

(D)

NO_3^- NH_4^+ NH_4^+ NO_2^-

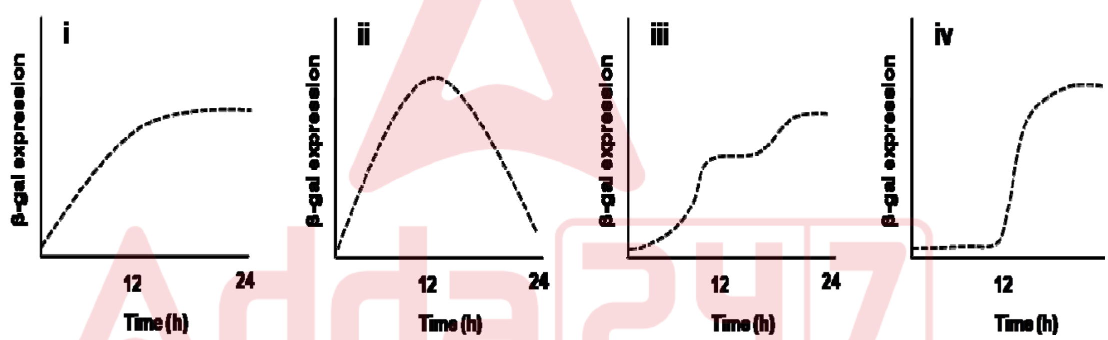
Q. 11 – Q. 20 carry two marks each.

Q.11 **TRUE?**



K_{eq} ΔGo

Q A E. coli ... glucose ... sole carbon source ... lactose ... E. coli ... lac ... ACCURATE representation of β



(ii) (iv)

END OF THE QUESTION PAPER

L : ZOOLOGY

Q. 1 – Q. 10 carry one mark each.

Q.1 The term “paedomorphosis” refers to

(A) Accelerated reproductive development as compared to somatic development
(B) A transient stage in the developmental event
(C) Two independent structures resembling each other, yet performing different functions
(D) A form of mimicry

Q.2 Which one of the following statements is TRUE when determining the age of a fossil using carbon dating?

(A) Carbon dating is based on carbon-13 to carbon-12 ratio in fossils
(B) Carbon dating is useful for determining the age of only fossils older than 100,000 years
(C) Older the fossil, lesser the carbon-14 to carbon-12 ratio
(D) Older the fossil, lesser the carbon-12 to carbon-14 ratio

Q.3 Constitutive enzymes are

(A) Induced by effector molecules
(B) Repressed by repressors
(C) Encoded by sequences that occur as part of an operon
(D) Always produced in the cell

Q.4 Which one of the following is a function of intermediate filaments?

(A) Chromosome movement during the cell division
(B) Cytoplasmic streaming
(C) Formation of tight junctions
(D) Anchorage of the nucleus

Q.5 Which one of the following statements is FALSE with respect to phospholipids?

(A) Phospholipids have amphipathic character
(B) Phospholipids form the lipid bilayer of the cell membrane
(C) Phospholipids form micelles in living systems
(D) Some phospholipid molecules may contain a double bond in hydrophobic tails

Q.6 Which one of the following organs is INCORRECTLY paired with its function?

(A) Intestinal villi – absorption
(B) Epiglottis – closure of larynx
(C) Gall bladder – carbohydrate digestion
(D) Parietal cells – hydrochloric acid

Q.7 Where do B lymphocytes acquire immune competence?

(A) Thymus (B) Bone Marrow (C) Lymph nodes (D) Spleen

Q.8 Which one of the following life cycle stages of *Plasmodium falciparum* is infectious?

(A) Sporozoite (B) Cryptozoite (C) Merozoite (D) Trophozoite

Q.9 What is the role of the notochord during organogenesis in a vertebrate embryo?

(A) Signaling the development of placenta
(B) Induction of neural plate formation
(C) Stimulation of the umbilical chord formation
(D) Suppression of the development of extra-embryonic membranes

Q.10 The behavior of young ducks following their mother is known as

(A) Imprinting (B) Innate behavior (C) Habituation (D) Mimicry

Q. 11 – Q. 20 carry two marks each.

Q.11 Match the species names with class names

P. *Calotes versicolor*	i. Insecta
Q. *Periplaneta americana*	ii. Reptilia
R. *Glyphidrilus birmancus*	iii. Actinopterygii
S. *Clarias batracus*	iv. Clitellata

(A) P-ii; Q-i, R-iv; S-iii (B) P-i; Q-ii; R-iii; S-iv
(C) P-ii; Q-i; R-iii; S-iv (D) P-iii; Q-i; R-ii; S-iv

Q.12 A population of spotted deer found in a national forest is in Hardy-Weinberg equilibrium. For a particular genetic locus in this deer species, only two alleles *A* and *a* are possible. If the frequency of the *A* allele in this population is 0.6, and the frequency of the *a* allele is 0.4, what will be the frequency of the genotype *Aa*?

(A) 0.24 (B) 0.48 (C) 0.96 (D) 1.6

Q.13 In *Drosophila*, the gene for eye colour is present on the X chromosome. When a red-eyed female was mated with a white-eyed male, a total of 100 progeny were obtained – 50 females and 50 males. Of the 50 females, 25 were red-eyed, and 25 were white-eyed. How many of the male progeny were red-eyed?

(A) 0 (B) 10 (C) 20 (D) 25

Q.14 Defect in poly-A tail formation in eukaryotic mRNA leads to

(A) Increased translation of the resulting mRNA
(B) Decreased translation of the resulting mRNA
(C) Premature transcription termination
(D) Decreased mRNA stability

Q.15 Assuming equal frequency for all 4 nucleotides (G, A, T, C), how many EcoRI recognition sites (GAATTC) are possible in a bacterial artificial chromosome of 100,000 base pairs?

(A) 6 (B) 12 (C) 24 (D) 48

Q.16 Choose the correct option that shows pairing of the organelle to its function

P. Smooth endoplasmic reticulum	i. Internalization of receptors
Q. Peroxisome	ii. Protein secretion
R. Golgi apparatus	iii. Membrane biogenesis
S. Endosome	iv. Breakdown of fatty acids

(A) P-i, Q-ii, R-iii, S-iv (B) P-i, Q-iii, R-ii, S-iv
(C) P-iii, Q-iv, R-ii, S-i (D) P-ii, Q-iii, R-iv, S-i

Q.17 Choose the correct option based on your understanding of the circulatory system

P. Open circulatory system	i. Fish
Q. Closed circulatory system	ii. Frog
R. Three chambered heart	iii. Earthworm
S. Two chambered heart	iv. Grasshopper

(A) P-iv; Q-iii; R-ii; S-i
(B) P-iv; Q-i; R-ii; S-iii
(C) P-i; Q-iv; R-ii; S-iii
(D) P-i; Q-iii; R-iv; S-ii

Q.18 The popular birth control pills for women have a combination of synthetic forms of estradiol and progesterone. Which one of the following statements is INCORRECT with regard to their function as contraceptive?

(A) The pills inhibit the release of GnRH leading to inhibition of gonadotropin-stimulated ovarian function
(B) They act directly on the pituitary gland to inhibit gonadotropin surges
(C) The low dose of estradiol in the pill inhibits the release of FSH, and thus blocks ovulation
(D) The synthetic forms of estradiol and progesterone bring about their effects by binding to their respective intracellular receptors

Q.19 Which one of the following is consistent with the germplasm theory of August Weismann?

(A) Regulative development observed in frog embryos
(B) Mosaic development observed in tunicates
(C) Normal embryonic development of embryos formed by somatic nuclear transfer
(D) Ability of differentiated cells to form pluripotent stem cells under certain conditions

Q.20 Which one of the following statements DOES NOT explain altruism?

(A) Altruism reduces the fitness of the individual that displays this behavior
(B) Altruism increases the fitness of other individuals in the population
(C) Altruism reduces the fitness of the individual that displays this behavior and at the same time increases the fitness of other individuals in the population
(D) Altruistic behavior helps the individual escape from predators

END OF THE QUESTION PAPER

Q. 1 – Q. 10 carry one mark each.

Q.1 Standard pasteurization protocol for milk is adequate for destroying

(A) *Clostridium sporogenes* (B) *Bacillus cereus*
(C) *Clostridium botulinum* (D) *Listeria monocytogenes*

Q.2 Which one of the following is NOT a component of an evaporator?

(A) Heat exchanger (B) Vacuum separator
(C) Condenser (D) Cyclone separator

Q.3 Among the following animal foods, the fat content is least in

(A) Beef (B) Chicken meat (C) Pork (D) Lamb flesh

Q.4 The enzyme that hydrolyzes starch to maltose is

(A) α-amylase (B) β-amylase
(C) glucoamylase (D) cyclodextrin glucanotransferase

Q.5 Which one of the following is NOT enriched in endosperm during parboiling of paddy?

(A) Thiamine (B) Niacin (C) Iron (D) Fat

Q.6 Heat-treated legume seed proteins are more digestible than those of untreated legume seed proteins due to

(A) reaction of reducing sugars with ε-amino group of lysine
(B) increased binding of lectins to intestinal mucosal cells
(C) thermolabile nature of lectins and Kunitz-type protease inhibitors
(D) thermolabile nature of Bowman-Birk type of inhibitor

Q.7 What is the percent relative humidity at which both the dry bulb and wet bulb thermometers would record equal temperatures?

(A) 0 (B) 10 (C) 50 (D) 100

Q.8 How many fold would the *g*-number of a centrifuge increase by doubling both the spinning speed and bowl diameter?

(A) 2 (B) 4 (C) 8 (D) 16

Q.9 Prolonged fermentation of cocoa seeds lead to "off-taste" due to the release of

(A) glucose
(B) short chain fatty acids
(C) carbon dioxide
(D) phospholipids

Q.10 The gradual decrease in viscosity of tomato paste during storage can be prevented by quickly heating it to 82 °C, because

(A) water soluble pectin interacts with calcium
(B) hemicellulose prevents decrease in viscosity
(C) lignin prevents decrease in viscosity
(D) pectin methyl esterase is inactivated

Q. 11 – Q. 20 carry two marks each.

Q.11 Match the enzymes in Group I with their corresponding application in Group II

Group I	Group II
(P) Chymosin	(1) Removal of cooked flavor from milk
(Q) Sulfhydryl oxidase	(2) Soybean milk coagulation
(R) β–Galactosidase	(3) For rennet puddings
(S) Microbial proteases	(4) Lactose removal

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

Q.12 Milk is flowing at 0.12 m^3/min in a 2.5 cm diameter pipe. The temperature of the milk is 21 °C and the corresponding viscosity and density are 2.1 x 10^{-3} Pas and 1029 kg/m^3, respectively. If the flow is found to be turbulent under the given conditions, the Reynolds number is _____

Q.13 Whole milk (34,950 kg) containing 4% fat is to be separated in 6 h period into skim milk with 0.45% fat and cream with 45% fat. The flow rate of cream stream (kg/h) from the separator is _____

Q.14 Match the plant sources in Group I with the pigments given in Group II

Group I	Group II
(P) Corn	(1) Lycopene
(Q) Red pepper	(2) β-Carotene
(R) Pumpkin	(3) Capsanthin
(S) Tomato	(4) Lutein

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

Q.15 Green tea is considered to be a more healthy option than black tea because it

(A) has high content of polyphenols
(B) is richer in theobromine
(C) does not require any sweetener during tea preparation
(D) has no microbial load

Q.16 A dilute pineapple juice is heated in a double pipe heat exchanger from 28 °C to 75 °C by heat exchanging with hot water flowing in shell in counter current direction. Hot water is entering the shell at 95 °C and leaving at 85 °C. The log mean temperature difference (°C) is _____

Q.17 Granulated sugar, having an average particle size of 500 µm, is milled to produce icing sugar having an average particle size of 25 µm. The power requirement was 10 kW as obtained by Rittinger's law. If the same mill were to be used to produce fondant sugar having an average particle size of 20 µm at the same capacity, the power requirement (kW) would be _____

Q.18 One ton of soybean containing 18% oil, 35% protein, 27.1% carbohydrates, 9.4% of fibre and ash, and 10.5% moisture is crushed and pressed. The residual oil content in the pressed cake is 6%. Assuming that there is no loss of protein and water with oil, the amount of oil (kg) obtained from the crusher is _____

Q.19 Match the processing methods in Group I with the corresponding description in Group II

Group I	Group II
(P) Degumming	(1) Crystallization of triacylglycerol by cooling to remove fat crystals
(Q) Deacidifying	(2) Passing heated oil over charcoal
(R) Bleaching	(3) Using alkaline solution to remove fatty acids
(S) Winterizing	(4) Wetting with water to remove lecithin

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

Q.20 The order of succession of microbes in the spoilage of milk, involving (P) *Lactobacillus*, (Q) protein digesting bacteria, (R) *Lactococcus lactis*, (S) yeasts and molds, is

(A) S>R>Q>P (B) S>Q>R>P (C) R>P>S>Q (D) Q>S>P>R

END OF THE QUESTION PAPER