QUESTION BOOKLET CODE **A**

2008-BT

Test Paper Code: BT

Time: 3 Hours **Max. Marks: 300**

INSTRUCTIONS

A. General:

1. This Question Booklet is your Question Paper.
2. This Question Booklet contains **20** pages and has 100 questions.
3. The Question Booklet **Code** is printed on the right-hand top corner of this page.
4. The Question Booklet contains blank spaces for your rough work. No additional sheets will be provided for rough work.
5. **Clip board, log tables, slide rule, calculator, cellular phone, pager and electronic gadgets in any form are NOT allowed.**
6. Write your **Name** and **Roll Number** in the space provided at the bottom.
7. All answers are to be marked only on the machine gradable Objective Response Sheet **(ORS)** provided along with this booklet, as per the instructions therein.
8. The Question Booklet along with the Objective Response Sheet **(ORS)** must be handed over to the Invigilator before leaving the examination hall.
9. Refer to **Useful Data** on reverse of this sheet.

B. Filling-in the ORS:

10. Write your Roll Number in the boxes provided on the upper left-hand-side of the **ORS** and darken the appropriate bubble under each digit of your Roll Number using a **HB pencil**.
11. Ensure that the **code** on the **Question Booklet** and the **code** on the **ORS** are t same. If the codes do not match, report to the Invigilator immediately.
12. On the lower-left-hand-side of the **ORS**, write your Name, Roll Number, Name of the Test Centre and put your signature in the appropriate box with ball-point pen. Do not write these anywhere else.

C. Marking of Answers on the ORS:

13. Each question has **4 choices** for its answer: (A), (B), (C) and (D). Only **ONE** of them is the correct answer.
14. On the right-hand-side of **ORS**, for each question number, darken with a **HB Pencil** ONLY one bubble corresponding to what you consider to be the most appropriate answer, from among the four choices.
15. There will be **negative marking** for wrong answers.

MARKING SCHEME:

(a) For each correct answer, you will be awarded **3 (Three)** marks.
(b) For each wrong answer, you will be awarded **-1 (Negative one)** mark.
(c) Multiple answers to a question will be treated as a wrong answer.
(d) For each un-attempted question, you will be awarded **0 (Zero)** mark.

Name							
Roll Number							

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Useful Data

Atomic No.: B, 5; C, 6; N, 7; O, 8; F, 9; Al, 13; Fe, 26; Co, 27; Ni, 28; Zn, 30; Tl, 81.

DO NOT WRITE ON THIS PAGE
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Q.1 In cells, cellulose and glycogen function as

(A) energy storage components.
(B) structural and energy storage components, respectively.
(C) energy storage and structural components, respectively.
(D) structural components.

Q.2 The structures of myoglobin and hemoglobin are

(A) Quaternary
(B) Quaternary and tertiary, respectively
(C) Tertiary and quaternary, respectively
(D) Molten globule

Q.3 The chromatographic technique for determination of the native molecular weight of proteins is

(A) Gel permeation
(B) Ion exchange
(C) Hydrophobic interaction
(D) Chromatofocusing

Q.4 The affinity of an enzyme to the substrate is indicated by

(A) pK_a (B) K_i (C) K_{cat} (D) K_m

Q.5 Which one of the following compounds is optically **INACTIVE**?

(A) Ala (B) Cys (C) Gly (D) Lys

Q.6 In O-linked glycoproteins, the glycan part is linked to the polypeptide. The amino acid residues involved in this linkage are

(A) Ser and Thr (B) Gln and Tyr (C) Tyr and Thr (D) Asn and Tyr

Q.7 The cofactor(s) required for the nitrogenase enzyme complex involved in N_2 fixation is/are

(A) Fe and Mo (B) Fe (C) Fe and S (D) Fe, S and Mo

Q.8 The anaplerotic (filling up) reaction to replenish citric acid cycle is

(A) decarboxylation of isocitrate to α-ketoglutarate.
(B) decarboxylation of α-ketoglutarate to succinyl CoA.
(C) carboxylation of phosphoenolpyruvate to oxaloacetate.
(D) conversion of malate to oxaloacetate.

Q.9 Which one of the following is **NOT** a neurotransmitter?

(A) Glutamine (B) Glutamate (C) Glycine (D) Acetylcholine

Q.10 Which one of the following is **NOT** an energy-rich compound?

(A) Phosphoenolpyruvate
(B) Glucose1,6-bisphosphate
(C) Acetyl phosphate
(D) Phosphoarginine

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Q.11 During photosynthesis, ATP synthesis takes place in

(A) stroma
(B) thylacoid lumen
(C) thylacoid membrane
(D) cytoplasm

Q.12 Contact inhibition phenomenon is observed in

(A) animal cell culture
(B) plant cell culture
(C) bacterial cell culture
(D) fungal cell culture

Q.13 Choose the correct set of match between **Group I** and **Group II.**

Group I	**Group II**
P. IgM	**1.** Present in various body secretions
Q. IgE	**2.** Antigen presentation
R. IgA	**3.** Allergic reaction
S. MHC	**4.** Complement activation
	5. Ten heavy chains and ten light chains

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

Q.14 Choose the correct set of match between **Group I** and **Group II.**

Group I	**Group II**
P. Gibberellins	**1.** Breaking dormancy
Q. Ethylene	**2.** Apical dominance
R. Cytokines	**3.** Fruit ripening
S. Abscisic acid	**4.** Seed germination
	5. Cell division and growth

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

Q.15 Choose the correct set of match between **Group I** and **Group II.**

Group I	**Group II**
P. Pyridoxal 5'-phosphate	**1.** Carboxylation reaction
Q. Biotin	**2.** One-carbon transfer reaction
R. Thiamine pyrophosphate	**3.** Decarboxylation reaction
S. N^5, N^{10}-methylene tetrahydrofolate	**4.** Oxidation-reduction reaction
	5. C-C bond cleavage

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

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Q.16 Choose the correct set of match between **Group I** and **Group II.**

Group I
P. Calcitonin
Q. Glucagon
R. Adrenalin
S. Prolactin

Group II
1. Blood glucose level regulation
2. Female reproductive system maintenance
3. Mammary gland development
4. Increase in basal metabolic rate
5. Calcium homeostasis

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

Q.17 Microaerophilic bacteria have the ability to grow in

(A) high concentration of oxygen
(B) absence of oxygen
(C) low concentration of oxygen
(D) low concentration of carbondioxide

Q.18 Cocci arranged in the form of chains are classified as

(A) Sterptococci (B) Micrococci (C) Sarcinae (D) Staphylococci

Q.19 The process of Tyndallization requires

P. Temperature of 100 °C
Q. Pressure of 15 psi
R. Time period of 30 min
S. Free flow of steam

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

Q.20 Choose the correct set of match between **Group I** and **Group II.**

Group I
P. *Campylobactor jejuni*
Q. *Neisseria gonorrhoeae*
R. *Pneumocystis carnii*
S. *Haemophilus aegyptius*

Group II
1. eye infection in human
2. lung disease in human with AIDS
3. intestinal disease with diarrhea
4. sexually transmitted disease
5. skin infection

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

Q.21 Asexual reproductive process of budding occurs in

(A) all fungi
(B) yeasts
(C) fungi undergoing sexual reproduction
(D) *Bacillus subtilis*

Q.22 One mL of *E. coli* culture was diluted to 100 mL and 0.5 mL of the diluted culture was plated on to an agar plate. After 12 h of incubation, 200 colonies were observed. What was the number of bacteria per mL in the original culture?

(A) 2×10^4 (B) 4×10^4 (C) 1×10^5 (D) 2×10^5

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Q.23 Phylogeny describes a species'

(A) morphological similarities with other species
(B) reproductive compatibilities with other species
(C) evolutionary history
(D) geographic distribution

Q.24 The term prophage refers to

(A) an auxotrophic mutant
(B) a phage DNA incorporated in to bacterial chromosome
(C) host DNA packed into viral particles
(D) DNA of lytic phage

Q.25 According to Darwin, two different areas within the same continent have different species because they have different

(A) evolutionary mechanisms
(B) ancestors
(C) environments
(D) evolutionary times

Q.26 A sequence of species through which an organic molecule passes in a community is referred to as

(A) pyramid of energy
(B) food chain
(C) food web
(D) nutrient cycle

Q.27 When a number of genes are transcribed as one mRNA, such mRNA is termed as

(A) multimeric (B) polymeric (C) polycistronic (D) polysomal

Q.28 The presence and location of a specific gene in a bacterial genome can be detected by

(A) Southern blot (B) Western blot (C) Eastern blot (D) Northern blot

Q.29 Match the terms in **Group I** with their definitions in **Group II.**

Group I	**Group II**
P. Ammonification	**1.** Conversion of atmospheric nitrogen into ammonia
Q. Denitrification	**2.** Conversion of organic nitrogen into ammonia
R. Nitrification	**3.** Conversion of nitrite or nitrate into atmospheric nitrogen
S. Nitrogen fixation	**4.** Conversion of ammonium into nitrite and nitrate

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

Q.30 Nucleosome is composed of

(A) DNA and histone proteins
(B) DNA, histone and non-histone proteins
(C) DNA, RNA and histone proteins
(D) RNA, histone and non-histone proteins

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Q.31 Usually there is one specific tRNA for each amino acid but some of the amino acids are recognized by more than one tRNA. The tRNAs that recognize the same amino acid are known as

(A) Cognate tRNAs
(B) Isoaccepting tRNAs
(C) Isoschizomers
(D) Catenated tRNAs

Q.32 Shine-Delgarno sequence is a part of

(A) Eukaryotic mRNA
(B) Prokaryotic mRNA
(C) Eukaryotic tRNA
(D) Eukaryotic rRNA

Q.33 Which of the following statements are **FALSE** about Palindromes?

P. DNA which reads the same sequence from both directions but in antiparallel orientation.
Q. DNA which reads the same sequence from both directions but in parallel orientation.
R. It is recognized by a specific restriction endonuclease and causes specific cleavage.
S. It is recognized by exonucleases and causes non-specific cleavage.

(A) **P** and **R** (B) **P** and **S** (C) **Q** and **R** (D) **Q** and **S**

Q.34 Which of the following statements are true regarding DNA replication?

P. It is semiconservative both in prokaryotes and eukaryotes.
Q. It is semiconservative in eukaryotes but conservative in prokaryotes.
R. Both leading and lagging strands are replicated by DNA Pol-III in prokaryotes.
S. Leading and lagging strands are replicated by two different polymerases in eukaryotes.

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

Q.35 Which of the following statements are true about genetic code and translation?

P. Genetic code is degenerate because more than one codon codes for a particular amino acid.
Q. Genetic code is degenerate because a single codon codes for more than one amino acid.
R. Genetic code degeneracy is due to wobble nature of 3' base.
S. Fidelity exists in translation as there is no proof reading mechanism.

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

Q.36 Which of the following techniques are used for transfer of a gene into the cells?

P. Electroporation
Q. Electroelution
R. Particle bombardment
S. Microinjection

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

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Q.37 Match the terms in **Group-I** with terms in **Group-II.**

Group-I	**Group-II**
P. RNA-P	**1.** *lac* operon
Q. Leucine zipper	**2.** rRNA gene transcription
R. RNA Pol-I	**3.** tRNA gene transcription
S. Attenuation	**4.** Transcription factors
	5. Ribozymes
	6. *trp* operon
	7. mRNA splicing

(A) **P-7, Q-5, R-3, S-1**
(B) **P-4, Q-5, R-2, T-1**
(C) **P-5, Q-4, R-2, S-6**
(D) **P-4, Q-5, R-3, T-6**

Q.38 Which one of the following modifications leads to protein degradation?

(A) Methylation (B) Acetylation (C) Phosphorylation (D) Ubiquitination

Q.39 Which one of the following protein is involved in the nucleation step of microtubules *in vivo*?

(A) α-Actin (B) β-Tubulin (C) α-Tubulin (D) γ-Tubulin

Q.40 If a codon in mRNA is UAC, the anticodon on tRNA will be

(A) 5'AUG3' (B) 5'GUA3' (C) 5'ATC3' (D) 5'CTA3'

Q.41 Which one of the following structure-function pairs is **NOT** correct?

(A) Nucleolus - rRNA synthesis
(B) Lysosome - intracellular digestion
(C) Endoplasmic reticulum - glycosylation
(D) Microtubules - muscle contraction

Q.42 Lysosomal protein targeting takes place through

(A) COP-coated vesicles
(B) Clathrin coated vesicles
(C) Liposome
(D) Receptor mediated endocytosis

Q.43 The release of Ca^{2+} from endoplasmic reticulum to cytoplasm in response to stimulus is mediated by

(A) cAMP (B) IP3 (C) DAG (D) Calmodulin

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Q.44 Match the terms in **Group-I** with terms in **Group-II.**

Group-I
P. Leucoplast
Q. Mitochondria
R. Golgi complex
S. Centriole

Group-II
1. Protein modification and targeting
2. Microtubule organizing centre
3. Starch storage
4. Kreb's cycle
5. Glycogen storage
6. Calvin cycle

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

Q.45 At constant pressure, the internal energy of a gaseous system will always decrease for

(A) an endothermic process with decrease in the volume.
(B) an endothermic process with increase in the volume.
(C) an exothermic process with decrease in the volume.
(D) an exothermic process with increase in the volume.

Q.46 First ionization energy of C, N, O and Si follows the order

(A) Si < O < N <C
(B) C < N < O < Si
(C) Si < C < N < O
(D) Si < C < O < N

Q.47 Which one of the following isoelectronic ions has the largest ionic radius?

(A) O^{2-} (B) F^{-} (C) Mg^{2+} (D) Na^{+}

Q.48 The correct set of match between molecules of **Group I** and their shapes in **Group II** is

Group I
P. I_3^-
Q. H_2S
R. $XeOF_4$
S. PCl_5

Group II
1. Square pyramidal
2. Trigonal bipyramidal
3. Linear
4. Angular

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

Q.49 Thallium (Tl) exhibits monovalency whereas aluminium (Al) exhibits trivalency. This is due to

(A) the energy required to unpair outer *s*-electrons in Tl exceeds the energy involved in the bond formation.
(B) Tl has only one electron in its outermost orbital.
(C) Al can use its vacant *d*-orbitals for the bond formation.
(D) Tl is a non-metal.

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Q.50 Which one of the following compounds has non-zero spin-only magnetic moment?

(A) $[Fe(CN)_6]^{4-}$ (B) $[Co(NH_3)_6]^{3+}$ (C) $[Zn(H_2O)_6]^{2+}$ (D) $[NiF_6]^{4-}$

Q.51 Isomerism exhibited by the pair of compounds $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ is

(A) linkage (B) coordination (C) ionization (D) geometric

Q.52 With increase in pressure, the equilibrium concentration of product will **NOT** change for

(A) $2\,CO_2\,(g) \leftrightarrows 2\,CO\,(g) + O_2\,(g)$
(B) $N_2\,(g) + 3\,H_2\,(g) \leftrightarrows 2\,NH_3\,(g)$
(C) $SO_2\,(g) \leftrightarrows S\,(s) + O_2\,(g)$
(D) $C_2H_4\,(g) + H_2\,(g) \leftrightarrows C_2H_6\,(g)$

Q.53 During a cyclic process, which one of the following is **NOT** always zero?

(A) Enthalpy change
(B) Entropy change
(C) Internal energy change
(D) Work done by the system

Q.54 The rate of reaction (r) is expressed as, $r = k\,[A]^m[B]^n$. The rate constant (k) for this reaction is $2\,L^2mol^{-2}s^{-1}$. The possible values of m and n are

(A) 1 and 1 (B) 1 and 2 (C) 1 and 3 (D) 1 and 4

Q.55 Half-cell reaction for the electrode $Ag/AgCl/Cl^-$ is

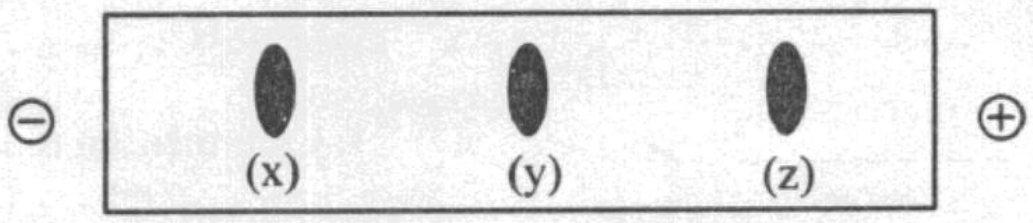
(A) $Ag^+ + e^- \rightarrow Ag\,(s)$
(B) $\frac{1}{2}\,Cl_2\,(g) + e^- \rightarrow Cl^-$
(C) $AgCl\,(s) + e^- \rightarrow Ag\,(s) + Cl^-$
(D) $Ag^+ + \frac{1}{2}\,Cl_2\,(g) + 2e^- \rightarrow Ag\,(s) + Cl^-$

Q.56 Which one of the following is **NOT** a correct statement for carbohydrates?

(A) Epimers give the same osazone.
(B) D(+)-glucose undergoes mutarotation.
(C) α-D(+)-glucose and β-D(+)-glucose are anomers.
(D) Conversion of α-D(+)-glucose to β-D(+)-glucose is called sugar inversion.

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Q.57 In an electrophoresis experiment at pH 5 (shown below) x, y and z refer respectively to

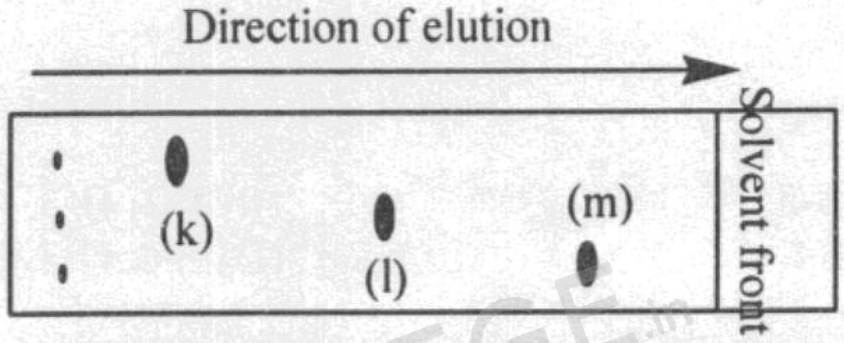


(A) Lysine, alanine and aspartic acid
(B) Alanine, aspartic acid and lysine
(C) Lysine, aspartic acid and alanine
(D) Aspartic acid, alanine and lysine

Q.58 Which one of the following 0.1 M solutions has the lowest pH?

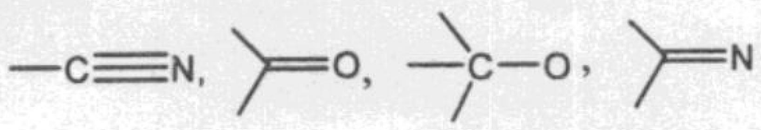
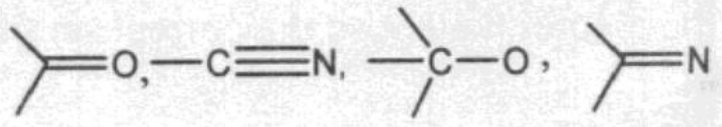
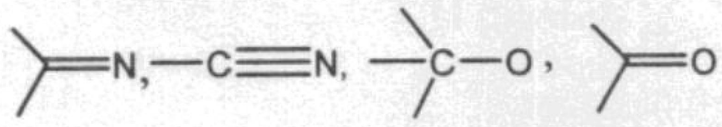
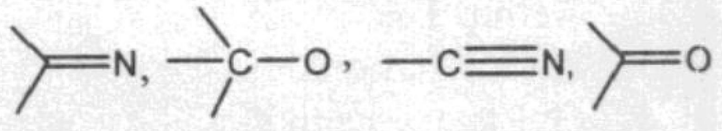
(A) $NaNO_2$ (B) NH_4Cl (C) NaCl (D) NH_3

Q.59 In a thin layer chromatography experiment, three spots k, l and m are detected in an iodine chamber. The spots k, l and m, respectively are

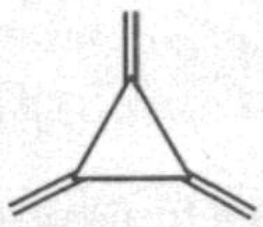
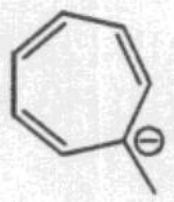
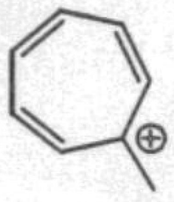
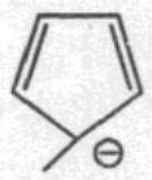


(A) $PhCH_2OH$, PhCOOH, $PhCH_2OCOCH_3$
(B) PhCOOH, $PhCH_2OCOCH_3$, $PhCH_2OH$
(C) PhCOOH, $PhCH_2OH$, $PhCH_2OCOCH_3$
(D) $PhCH_2OCOCH_3$, $PhCH_2OH$, PhCOOH

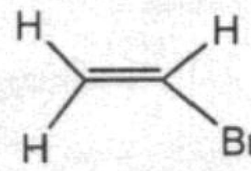
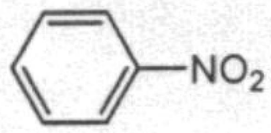
Q.60 IR stretching frequency at ~2200, ~1700, ~1100 and ~1600 cm^{-1} corresponds respectively to the functional groups

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

Q.61 Which one of the following species does **NOT** have 6 π electrons?

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

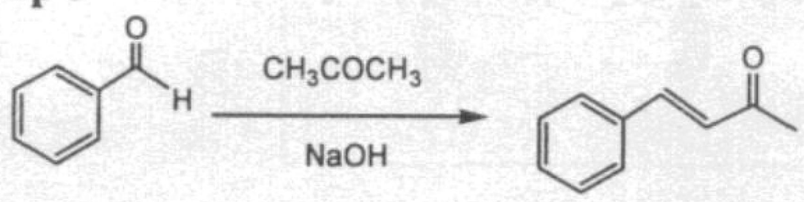
Q.62 Which one of the following compounds will **NOT** show three signals in its ^1H NMR spectrum?

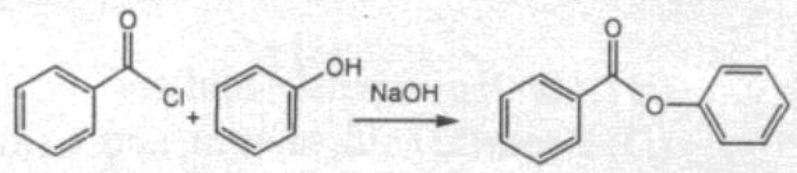
(A) $CH_3CH_2CH_2Br$
(B) 
(C) $CH_3OCH_2CH_2OCH_3$
(D) 

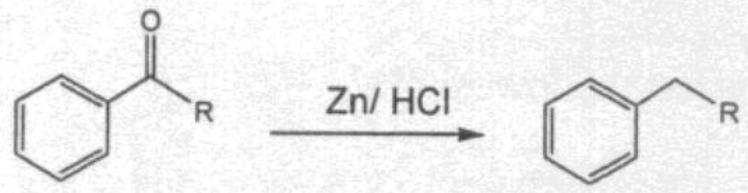
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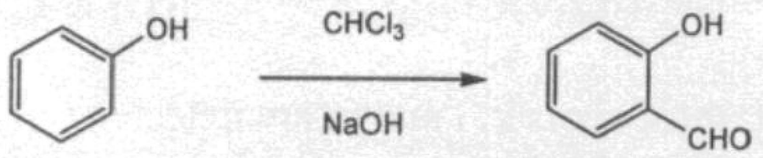
Q.63 Choose the correct match between reactions of **Group I** and named reactions in **Group II**.

Group I

P. 

Q. 

R. 

S. 

Group II

1. Clemmensen reduction

2. Schotten-Bauman reaction

3. Aldol condensation

4. Hoffman degradation

5. Reimer-Tiemann reaction

6. Sandmeyer reaction

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

Q.64 (+)-Mandelic acid has a specific rotation of +160°. What is the observed specific rotation of a mixture of 40% (-)-mandelic acid and 60% (+)-mandelic acid?

(A) -32° (B) +32° (C) +64° (D) -64°

Q.65 **Group I** lists fundamental forces in nature and **Group II** lists the particles relevant to these forces. Choose the correct set of match.

Group I	**Group II**
P. Gravitational	**1.** Charges
Q. Electromagnetic	**2.** Nucleons
R. Weak nuclear	**3.** Masses
S. Strong nuclear	**4.** Elementary particles

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

Q.66 A small body of mass 0.2 kg undergoes a uniform circular motion on a frictionless horizontal surface. The body is attached to the centre by a string of length 2 m and has a linear speed of 10 m/s. The force exerted by the string on the mass is

(A) 1 N (B) 5 N (C) 10 N (D) 50 N

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Q.67 Resistance (R), capacitance (C), and inductance (L) are connected in series in a circuit. Keeping the resonant frequency same, the quality factor (Q) can be doubled if

(A) L is increased to $2L$ and C is decreased to $C/2$
(B) C is increased to $2C$ and L is decreased to $L/2$
(C) L is increased to $4L$ and C is decreased to $C/4$
(D) C is increased to $4C$ and L is decreased to $L/4$

Q.68 de Broglie wavelengths of two electrons which start from rest and accelerated by potentials V and 4V are λ_1 and λ_2 respectively. The ratio $\lambda_1 : \lambda_2$ is

(A) 1:2 (B) 1:4 (C) 2:1 (D) 4:1

Q.69 The mass numbers of two nuclei M and N are 4 and 8 respectively. The ratio of the volumes of the nuclei, $V_M : V_N$ is

(A) 1:2 (B) 1:4 (C) 1:8 (D) 1:16

Q.70 A student is interested in converting a galvanometer into a voltmeter. The student should

(A) connect a large resistance in series with the galvanometer.
(B) connect a large resistance in parallel to the galvanometer.
(C) connect a small resistance in series with the galvanometer.
(D) connect a small resistance in parallel to the galvanometer.

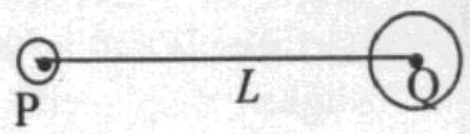
Q.71 The phase difference between points that are 2 m apart along the direction of propagation of a wave having a wavelength of 6 m is

(A) 60° (B) 120° (C) 150° (D) 180°

Q.72 A car moving at a constant speed of 36 km/h in the direction of wind and assisted by the flow of wind which imparts a force of 50 N. The frictional force between the tyres and the road is 100 N. The engine power required is

(A) 50 W (B) 100 W (C) 500 W (D) 1800 W

Q.73 The centres of two planets (P and Q) are at a distance L apart and the ratio of their masses is 1:4. What is the distance between the centre of the lighter planet (P) and the point on the line PQ at which the net gravitational force is zero?



(A) $L/4$ (B) $L/3$ (C) $L/2$ (D) $3L/4$

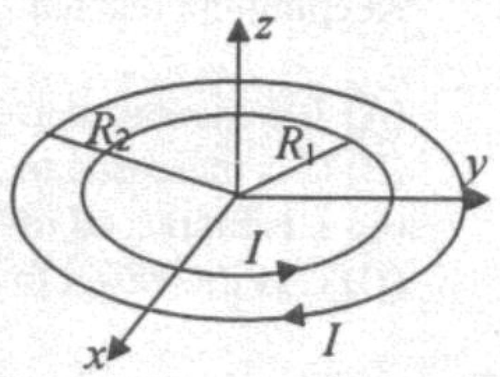
Q.74 A charge is placed on a solid conductor. Under static condition, which one of the following statements is **FALSE?**

(A) There is no free charge in the interior of the conductor.
(B) Potential is constant over the surface of the conductor.
(C) Electric field is zero inside the conductor.
(D) Electric field at the surface has both normal and tangential components.

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Q.75 A circular wire of radius R_1 carrying a current I in the anticlockwise direction is concentric with another circular wire of radius R_2 ($R_2 > R_1$) also carrying a current I in the clockwise direction as shown in the figure. The magnetic field $\vec{B}$ at the centre is



(A) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)\hat{z}$ (B) $-\frac{\mu_0 I}{2}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)\hat{z}$

(C) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)\hat{z}$ (D) $-\frac{\mu_0 I}{2}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)\hat{z}$

Q.76 The ionization energy for a hydrogen atom in its first excited state ($n = 2$) is

(A) 13.6 eV (B) 3.4 eV (C) -3.4 eV (D) -13.6 eV

Q.77 The volume expansion coefficient for a uniform solid cube is γ and the linear expansion coefficient is α. For small temperature changes, the relationship between α and γ is

(A) $\gamma = \sqrt[3]{\alpha}$ (B) $\gamma = \alpha/3$ (C) $\gamma = 3\alpha$ (D) $\gamma = \alpha^3$

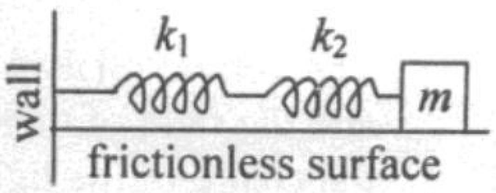
Q.78 The velocity (v) of a particle moving along positive x-axis is given by

$v = k\sqrt{x}$ where k is a positive constant.

At time $t = 0$ the particle is at $x = 0$. The distance of the particle as a function of time is given by

(A) $x = kt^{1/2}$ (B) $x = k^2 t$ (C) $x = kt^{3/2}$ (D) $x = k^2 t^2$

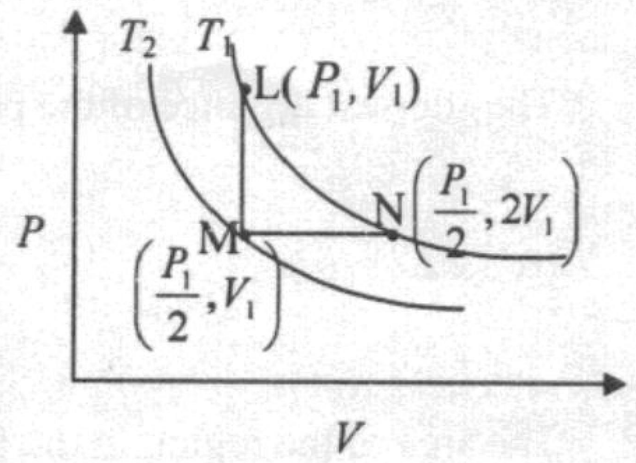
Q.79 Two springs of spring constants, k_1 and k_2 are connected in series where one end is fixed to a wall and other end is connected to a block of mass m. The arrangement is kept on a frictionless surface. What is the frequency of oscillation when the mass is slightly displaced?



(A) $\frac{1}{2\pi}\sqrt{\frac{k_1 k_2}{m(k_1+k_2)}}$ (B) $\frac{1}{2\pi}\sqrt{\frac{k_1+k_2}{m}}$ (C) $\frac{1}{2\pi}\sqrt{\frac{k_1+k_2}{2m}}$ (D) $\frac{1}{2\pi}\sqrt{\frac{k_1+k_2}{mk_1k_2}}$

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Q.80 L, M and N are points on the isotherms (T_1 and T_2) as shown in the figure. If W_{LM}, W_{MN} and W_{LN} denote the work done by one mole of an ideal gas along the paths LM, MN and LN respectively, then
(ln2 = 0.693)

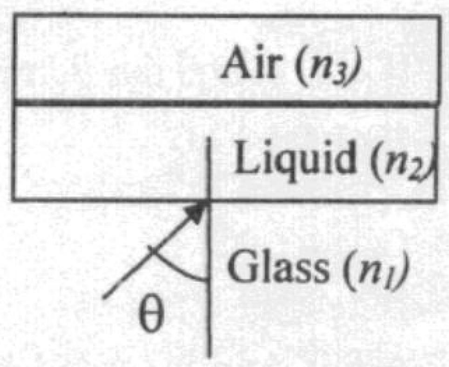


(A) $W_{LN} > W_{LM} > W_{MN}$
(B) $W_{LM} > W_{MN} > W_{LN}$
(C) $W_{LN} > W_{MN} > W_{LM}$
(D) $W_{MN} > W_{LN} > W_{LM}$

Q.81 In Si single crystal, the intrinsic carrier concentration n_i at temperature T_1 is twice that of at temperature T_2. Then for an n-type Si crystal,

(A) electron concentration n at T_1 is twice to that of n at T_2.
(B) electron concentration n at T_1 is four times to that of n at T_2.
(C) hole concentration p at T_1 is twice to that of p at T_2.
(D) hole concentration p at T_1 is four times to that of p at T_2.

Q.82 The minimum value of θ as shown in the figure for which total internal reflection occurs at the interface between liquid and air is (refractive indices of the media are given in brackets in the figure and $n_1 > n_2 > n_3$)



(A) $\sin^{-1}\frac{n_2}{n_1}$
(B) $\sin^{-1}\frac{n_3}{n_1}$
(C) $\sin^{-1}\frac{n_1}{n_2}$
(D) $\sin^{-1}\frac{n_1}{n_3}$

Q.83 If the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} + 2\hat{j} + p\hat{k}$ are **coplanar**, then the value of p is

(A) - 2
(B) – 1
(C) 1
(D) 2

Q.84 A committee of 4 members is to be formed out of 6 men and 4 women. If the committee has to include at least 2 women and a particular woman is always selected, the number of ways it can be formed is

(A) 36
(B) 60
(C) 64
(D) 90

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Q.85 The shortest distance of the point (1, 0, 1) from the straight line given by $\frac{x-4}{-2}=\frac{y}{1}=\frac{z-1}{-1}$ is

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

Q.86 The area of the region in the first quadrant bounded by the curves $y=x^2$ and $y=x^3$ is

(A) 1/12 (B) 1/6 (C) 1/2 (D) 3/4

Q.87 The value of $\lim_{x\to 0^+} x\ln x$ is

(A) -1 (B) e (C) 1 (D) 0

Q.88 If $\theta=\pi/14$, then the value of $\frac{\cos 8\theta}{\sin\theta}$ is

(A) 0 (B) -1 (C) 1/14 (D) 1

Q.89 If $\tan A$ and $\tan B$ are the roots of the equation $x^2-px+q=0$, then the value of $\tan(A+B)$ is

(A) p/q (B) q/p (C) $q/(1-p)$ (D) $p/(1-q)$

Q.90 A fair coin is tossed 100 times. The probability of getting tails an odd number of times is

(A) 1/8 (B) 1/4 (C) 3/8 (D) 1/2

Q.91 If y is a function of x given by $y=\sqrt{x+\sqrt{x+\sqrt{x+\sqrt{x+\cdots}}}}$, then $\frac{dy}{dx}$ at (0,0) is

(A) -1 (B) 0 (C) 1 (D) $\sqrt{2}$

Q.92 If a is given by $a=\frac{1}{2}-\frac{1}{8}+\frac{1}{24}-\frac{1}{64}+\cdots$, then the value of e^{-a} is

(A) 1/2 (B) 2/3 (C) 1 (D) 3/2

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Q.93 The complex number $\left(\frac{\sqrt{3}}{2}+i\frac{1}{2}\right)^6$ equals

(A) -1 (B) 1 (C) $i-\sqrt{3}$ (D) $i+\sqrt{3}$

Q.94 If λ_1 and λ_2 are the values of λ for which $\begin{vmatrix} 1 & \lambda & 0 \\ \lambda & 2 & 1 \\ 0 & 1 & 1 \end{vmatrix} = 0$, then $\lambda_1 + \lambda_2$ equals

(A) -1 (B) 0 (C) 1 (D) 2

Q.95 The distance of the point (1/2 , 0) and the line of intersection of the circles $x^2 + y^2 = 4$ and $(x+1)^2 + y^2 = 4$ is

(A) $1/\sqrt{2}$ (B) $\sqrt{2}$ (C) 1 (D) 2

Q.96 The maximum area of a rectangle inscribed in a circle of radius a is

(A) a^2 (B) $2a^2$ (C) $3a^2$ (D) $4a^2$

Q.97 A missile is projected from the ground at an angle of 45° with the vertical. If it has to hit a target 50 m high at a horizontal distance of 100 m, the velocity of projection is
(g *is the acceleration due to gravity*)

(A) $10\sqrt{6g}$ m/s (B) $10\sqrt{5g}$ m/s (C) $10\sqrt{3g}$ m/s (D) $10\sqrt{2g}$ m/s

Q.98 The maximum value of $3x_1 + 5x_2$ subject to the constraints

$$0 \le x_1 \le 4,$$
$$0 \le x_2 \le 6,$$
$$3x_1 + 2x_2 \le 18$$

is

(A) 21 (B) 27 (C) 30 (D) 36

Q.99 The function $y(x)$ satisfies the differential equation $\frac{dy}{dx} = \tan x$. If $y(\pi/4) = 0$, then $y(\pi/3)$ is

(A) $\ln 2$ (B) $\ln\sqrt{2}$ (C) 1 (D) e

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Q.100 The sum of the series $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+\frac{1}{4.5}+\cdots+\frac{1}{n\,(n+1)}+\cdots$ is

(A) 2 (B) 0.5 (C) 1 (D) 0.25

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