Plant Kingdom

1. Which of the following algae produce Carrageen?
  a. Brown algae   b. Red algae
  c. Blue-green algae   d. Green algae

2. Genera like *Selaginella* and *Salvinia* produce two kinds of spores. Such plants are known as:
  a. Heterosorus   b. Homosporous
  c. Heterosporous   d. Homosorus

3. Which of the following algae contains mannitol as reserve food material?
  a. *Gracilaria*   b. *Volvox*
  c. *Ulothrix*   d. *Ectocarpus*

4. Gemmae are present in:
  a. Pteriodophytes   b. Some Gymnosperms
  c. Some Liverworts   d. Mosses

Morphology of Flowering Plants

5. Diadelphous stamens are found in:
  a. Citrus   b. Pea
  c. China rose and citrus   d. China rose

Anatomy of Flowering Plants

6. Match List -1 with List - 2

	List- 1		List - 2
A.	Lenticels	(i)	Phellogen
B.	Cork cambium	(ii)	Suberin deposition
C.	Secondary cortex	(iii)	Exchange of gases
D.	Cork	(iv)	Phelloderm

Choose the correct answer from the options given below:

  a.   A-iii   B-i   C-iv   D-ii
  b.   A-ii   B-iii   C-iv   D-i
  c.   A-iv   B-ii   C-i   D-iii
  d.   A-iv   B-i   C-iii   D-ii

7. Match List - 1 with List - 2

	List- 1		List - 2
A.	Cells with active cell division capacity	(i)	Vascular tissues
B.	Tissue having all cells similar in structure and function	(ii)	Meristematic tissue
C.	Tissue having different types of cells	(iii)	Sclereids
D.	Dead cells with highly thickened walls and narrow lumen	(iv)	Simple Tissue

Select the correct answer from the options given below.

  a.   A-iv   B-iii   C-ii   D-i
  b.   A-i   B-ii   C-iii   D-iv
  c.   A-iii   B-ii   C-iv   D-i
  d.   A-ii   B-iv   C-i   D-iii

Cell: The Unit of Life

8. Which of the following is an **incorrect** statement?

  a. Microbodies are present both in plant and animal cells.

  b. The perinuclear space forms a barrier between the materials present inside the nucleus and that of the cytoplasm.

  c. Nuclear pores act as passages for proteins and RNA molecules in both directions between nucleus and cytoplasm.

  d. Mature sieve tube elements possess a conspicuous nucleus and usual cytoplasmic organelles.

9. Match List- 1 with List- 2

	List- 1		List - 2
A.	Cristae	(i)	Primary constriction in chromosome
B.	Thylakoids	(ii)	Disc-shaped sacs in Golgi apparatus
C.	Centromere	(iii)	Infoldings in mitochondria
D.	Cisternae	(iv)	Flattened membranous sacs in stroma of plastids

Choose the correct answer from the options given below.

a. A-i   B-iv   C-iii   D-ii
b. A-iii   B-iv   C-i   D-ii
c. A-ii   B-iii   C-iv   D-i
d. A-iv   B-iii   C-ii   D-i

10. When the centromere is situated in the middle of two equal arms of chromosomes, the chromosome is referred as:

a. Telocentric   b. Sub-metacentric
c. Acrocentric   d. Metacentric

Biomolecules

11. Which of the following are **not** secondary metabolites in plants?

a. Amino acids, glucose   b. Vinblastin, curcumin
c. Rubber, gums   d. Morphine, codeine

Cell Cycle and Cell Division

12. Which of the following stages of meiosis involves division of centromere?

a. Metaphase II   b. Anaphase II
c. Telophase II   d. Metaphase I

Transport in Plants

13. Match List -1 with List - 2

	List- 1		List - 2
A.	Cohesion	(i)	More attraction in liquid phase
B.	Adhesion	(ii)	Mutual attraction among water molecules
C.	Surface tension	(iii)	Water loss in liquid phase
D.	Guttation	(iv)	Attraction towards polar surfaces

Choose the correct answer from the options given below.

a. A-iv   B-iii   C-ii   D-i
b. A-iii   B-i   C-iv   D-ii
c. A-ii   B-i   C-iv   D-iii
d. A-ii   B-iv   C-i   D-iii

Photosynthesis in Higher Plants

14. The first stable product of CO_2 fixation in **sorghum** is:

a. Oxaloacetic acid
b. Succinic acid
c. Phosphoglyceric acid
d. Pyruvic acid

Plant Growth and Development

15. The site of perception of light in plants during photoperiodism is:

a. Stem   b. Axillary bud
c. Leaf   d. Shoot apex

16. The plant hormone used to destroy weeds in a field is:

a. NAA   b. 2, 4-D   c. IBA   d. IAA

17. Plants follow different pathways in response to environment or phase of life to form different kinds of structures. This ability is called:

a. Flexibility   b. Plasticity
c. Maturity   d. Elasticity

Reproduction of Organisms

18. Which of the following plants is monoecious?

a. Chara
b. *Marchantia polymorpha*
c. *Cycas circinalis*
d. *Carica papaya*

Sexual Reproduction in Flowering Plants

19. A typical angiosperm embryo sac at maturity is:

a. 7- nucleate and 8-celled
b. 7- nucleate and 7-celled
c. 8- nucleate and 8- celled
d. 8-nucleate and 7- celled

20. The term used for transfer of pollen grains from anthers of one plant to stigma of different plant which, during pollination, brings genetically different types of pollen grains to stigma, is:

a. Geitonogamy   b. Chasmogamy
c. Cleistogamy   d. Xenogamy

Principles of Inheritance and Variation

21. The production for gametes by the parents, formation of zygotes, the F_1 and F_2 plants,can be understood from a diagram called:

a. Punch square   b. Punnett square

c. Net square   d. Bullet square

Molecular Basis of Inheritance

22. Complete the flow chart on central dogma.

$$(A) \circlearrowleft DNA \xrightarrow{(B)} mRNA \xrightarrow{(C)} (D)$$

a. (A)-Translation;(B)-Replication;
   (C)-Transcription;(D)- Transduction

b. (A)-Replication;(B)-Transcription;
   (C)-Translation; (D)-Protein

c. (A)-Transduction;(B)-Translation;
   (C)-Replication; (D)-Protein

d. (A)-Replication;(B)-Transcription
   (C)-Transduction;(D)-Protein

Evolution

23. The factor that leads to Founder effect in a population is:

a. Genetic recombination

b. Mutation

c. Genetic drift

d. Natural selection

Strategies for Enhancement in Food Production

24. Mutations in plant cells can be induced by:

a. Infrared rays   b. Gamma rays

c. Zeatin   d. Kinetin

25. Match List - 1 with List - 2

	List- 1		List - 2
A.	Protoplast fusion	(i)	Totipotency
B.	Plant tissue culture	(ii)	Pomato
C.	Meristem culture	(iii)	Somaclones
D.	Micropropagation	(iv)	Virus free plants

Choose the correct answer from the options given below.

a. A-ii   B-i   C-iv   D-iii

b. A-iii   B-iv   C-i   D-ii

c. A-iv   B-iii   C-ii   D-i

d. A-iii   B-iv   C-ii   D-i

Biotechnology-Principles and Processes

26. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out:

a. DNA   b. Histones

c. Polysaccharides   d. RNA

27. DNA strands on a gel stained with ethidium bromide when viewed under UV radiation, appear as:

a. Bright orange bands   b. Dark red bands

c. Bright blue bands   d. Yellow bands

Biotechnology and Its Applications

28. When gene targetting involving gene amplification is attempted in an individual's tissue to treat disease, it is known as:

a. Gene therapy   b. Molecular diagnosis

c. Safety testing   d. Biopiracy

29. Which of the following is **not** an application of PCR (Polymerase Chain Reaction) ?

a. Gene amplification

b. Purification of isolated protein

c. Detection of gene mutation

d. Molecular diagnosis

30. Which of the following is a correct sequence of steps in a PCR (Polymerase Chain Reaction)?

a. Denaturation, Extension, Annealing

b. Extension, Denaturation, Annealing

c. Annealing, Denaturation, Extension

d. Denaturation, Annealing, Extension

Organisms and Populations

31. Inspite of interspecific competition in nature, which mechanism the competing species might have evolved for their survival?

a. Competitive release   b. Mutualism

c. Predation   d. Resource Partitioning

32. Amensalism can be represented as:

a. Species A (+) ; Species B (+)

b. Species A (-) ; Species B (-)

c. Species A (+) ; Species B (0)

d. Species A (-) : Species B (0)

Ecosystem

33. The amount of nutrients, such as carbon, nitrogen, phosphorus and calcium present in the soil at any given time is referred as:

a. Climax community   b. Standing state

c. Standing crop   d. Climax

35. Which of the following statements is **not** correct ?

    a. Pyramid of biomass in sea is generally upright.

    b. Pyramid of energy is always upright.

    c. Pyramid of numbers in a grassland ecosystem is upright.

    d. Pyramid of biomass in sea is generally inverted.

35. In the equation GPP- R = NPP.

    R represents:

    a. Retaradation factor

    b. Environment factor

    c. Respiration losses

    d. Radiant energy

SECTION-B (BOTANY)

Biological Classification

36. Which of the following statements is correct ?

    a. Fusion of protoplasms between two motile or non- motile gametes is called plasmogamy.

    b. Organisms that depend on living plants are called saprophytes.

    c. Some of the organisms can fix atmospheric nitrogen in specialized cells called sheath cells.

    d. Fusion of two cells is called Karyogamy.

Morphology of Flowering Plants

37. Match Column - I with Column - II

	Column-I		Column-II
A.	$\%\overset{\nearrow}{\underset{+}{\text{O}}} K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$	(i)	Brassicaceae
B.	$\oplus\overset{\nearrow}{\underset{+}{\text{O}}} K_{(5)} \overset{\frown}{C_{(5)}} A_5 \underline{G}_2$	(ii)	Liliaceae
C.	$\oplus\overset{\nearrow}{\underset{+}{\text{O}}} \overset{\frown}{P_{(3+3)}} A_{3+3} \underline{G}_{(3)}$	(iii)	Fabaceae
D.	$\oplus\overset{\nearrow}{\underset{+}{\text{O}}} K_{2+2} C_4 A_{2-4} \underline{G}_{(2)}$	(iv)	Solanaceae

Select the correct answer from the options given below.

    a.   A-i   B-ii   C-iii   D-iv

    b.   A-ii   B-iii   C-iv   D-i

    c.   A-iv   B-ii   C-i   D-iii

    d.   A-iii   B-iv   C-ii   D-i

Anatomy of Flowering Plants

38. Select the correct pair.

a.	In dicot leaves, vascular bundles are surrounded by large thick-walled cells	-	Conjunctive tissue
b.	Cells of medullary rays that form part of cambial rings	-	Interfascicular cambium
c.	Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark	-	Spongy parenchyma
d.	Large colorless empty cells in the epidermis of grass leaves	-	Subsidiary cells

Biomolecules

39. Match List - 1 with List - 2

	List- 1		List - 2
A.	Protein	(i)	C = C double bonds
B.	Unsaturated fatty acid	(ii)	Phosphodiester bonds
C.	Nucleic acid	(iii)	Glycosidic bonds
D.	Polysaccharide	(iv)	Peptide bonds

Choose the correct answer from the options given below.

    a.   A-i   B-iv   C-iii   D-ii

    b.   A-ii   B-i   C-iv   D-iii

    c.   A-iv   B-iii   C-i   D-ii

    d.   A-iv   B-i   C-ii   D-iii

Cell Cycle and Cell Division

40. Match List - 1 with List - 2

	List- 1		List - 2
A.	S phase	(i)	Proteins are synthesized
B.	G_2 phase	(ii)	Inactive phase
C.	Quiescent stage	(iii)	Interval between mitosis and initiation of DNA replication
D.	G_1 phase	(iv)	DNA replication

Choose the correct answer from the options given below.

a. A-iv   B-ii   C-iii   D-i
b. A-iv   B-i   C-ii   D-iii
c. A-ii   B-iv   C-iii   D-i
d. A-iii B-ii   C-i   D-iv

Mineral Nutrition

41. Match Column - I with Column - II

	List- 1		List - 2
A.	*Nitrococcus*	(i)	Denitrification
B.	*Rhizobium*	(ii)	Conversion of ammonia to nitrite
C.	*Thiobacillus*	(iii)	Conversion of nitrite to nitrate
D.	*Nitrobacter*	(iv)	Conversion of atmospheric nitrogen to ammonia

Choose the correct answer from options given below.

a. A-i   B-iv   C-iii   D-iv
b. A-iii B-i   C-iv   D-ii
c. A-iv   B-iii C-ii   D-i
d. A-ii   B-iv   C-i   D-iii

Photosynthesis in Higher Plants

42. Which of the following statements is **incorrect**?
a. Stroma lamellae have PS I only and lack NADP reductase.
b. Grana lamellae have both PS I and PS II.
c. Cyclic photophosphorylation involves both PS I and PS II.
d. Both ATP and NADPH + H^+ are synthesized during non-cyclic photophosphorylation.

Respiration in Plants

43. Which of the following statements is **incorrect**?
a. In ETC (Electron Transport Chain), one molecule of NADH + H^+ gives rise to 2 ATP molecules, and one $FADH_2$ gives rise to 3 ATP molecules.
b. ATP is synthesized through complex V.
c. Oxidation - reduction reactions produce proton gradient in respiration,
d. During aerobic respiration, role of oxygen is limited to the terminal stage.

Sexual Reproduction in Flowering Plants

44. In some members of which of the following pairs of families, pollen grains retain their viability for months after release ?
a. Poaceae ; Leguminosae
b. Poaceae ; Solanaceae
c. Rosaceae ; Leguminosae
d. Poaceae ; Rosaceae

Molecular Basis of Inheritance

45. What is the role of RNA ploymerase III in the process of transcription in eukaryotes?
a. Transcribes tRNA, 5s rRNA and sn RNA
b. Transcribes precursor of mRNA
c. Transcribes only snRNAs
d. Transcribes rRNAs (28S, 18S and 5.8S)

46. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence, called as:
a. Repetitive DNA
b. Single nucleotides
c. Polymorphic DNA
d. Satellite DNA

47. Identify the correct statement.
a. RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.
b. The coding strand in transcription unit is copied to an mRNA.
c. Split gene arrangement is characteristic of prokaryotes.
d. In capping, methyl guanosine triphosphate is added to the 3′ end of hnRNA.

Biotechnology-Principles and Processes

48. Plasmid pBR322 has PstI restriction enzyme site within gene amp^R that confers ampicillin resistance, If this enzyme is used for <u>inserting a gene for β-galactoside</u> production and the recombinant plasmid is inserted in an *E.coli* strain   **(Section-B)**

a. The transformed cells will have the ability to resist ampicillin as well as produce β-galactoside.
b. It will lead to lysis of host cell.
c. It will be able to produce a novel protein with dual ability.
d. It will not be able to confer ampicillin resistance to host cell.

Biotechnology and Its Applications

49. Now a days it is possible to detect the mutated gene causing cancer by allowing radioactive probe to hybridise its complimentary DNA in a clone of cells, followed by its detection using <u>autoradiography</u> because:

a. Mutated gene completely and clearly appears on a photographic film.
b. Mutated gene does not appear on a photographic film as the prober has no complimentarity with it.
c. Mutated gene does not appear on a photographic film as the probe has complimentarity with it.
d. Mutated gene partially appears on a photographic film.

Organisms and Populations

50. In the exponential growth equation

$N_t = N_o e^{rt}$, e represents:

a. The base of exponential logarithms
b. The base of natural logarithms
c. The base of geometric logarithms
d. The base of number logarithms

SECTION-A (ZOOLOGY)

The Living World

51. Which one of the following belongs to the <u>family Muscidae</u>?

a. Grasshopper   b. Cockroach
c. Housefly   d. Fire fly

Animal Kingdom

52. Match List-I with List-II

List-I		List-II	
(A)	Metamerism	(i)	Coelenterata
(B)	Canal system	(ii)	Ctenophora
(C)	Comb plates	(iii)	Annelida
(D)	Cnidoblasts	(iv)	Porifera

Choose the correct answer from the options given below.

a.   A-iii   B-iv   C-i   D-ii
b.   A-ii   B-iv   C-ii   D-i
c.   A-iv   B-i   C-ii   D-iii
d.   A-iv   B-iii   C-i   D-ii

53. Which one of the following organisms bears <u>hollow</u> and <u>pneumatic long bones</u>?

a. *Hemidactylus*   b. *Macropus*
c. *Ornithorhynchus*   d. *Neophron*

54. Match the following:

List-I		List-II	
(A)	*Physalia*	(i)	Pearl oyster
(B)	*Limulus*	(ii)	Portuguese Man of War
(C)	*Ancylostoma*	(iii)	Living fossil
(D)	*Pinctada*	(iv)	Hookworm

Choose the correct answer from the options given below.

a.   A-iv   B-i   C-iii   D-ii
b.   A-ii   B-iii   C-iv   D-i
c.   A-i   B-iv   C-iii   D-ii
d.   A-ii   B-iii   C-i   D-iv

55. Read the following statements.

A. Metagenesis is observed in Helminths.

B. Echinoderms are triploblastic and coelomate animals.

C. Round worms have organ-system level of body organization.

D. Comb plates present in ctenophores help in digestion.

E. Water vascular system is characteristic of Echinoderms.

Choose the correct answer from the options given below.

a. A, B and C are correct
b. A, D and E are correct
c. B, C and E are correct
d. C, D and E are correct

Structural Organisation in Animals

56. Which of the following characteristics is **incorrect** with respect to cockroach?

a. Hypopharynx lies within the cavity enclosed by the mouth parts.
b. In females, 7th - 9th sterna together form a genital pouch.
c. 10th abdominal segment in both sexes, bears a pair of anal cerci.
d. A ring of gastric caeca is present at the junction of midgut and hind gut.

57. Which of the following statements **wrongly** represents the nature of smooth muscle?

a. They are involuntary muscles
b. Communication among the cells is performed by intercalated discs
c. These muscles are present in the wall of blood vessels
d. These muscle have no striations

Cell: The Unit of Life

58. The organelles that are included in the endomembrane system are:

a. Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles.
b. Golgi complex, Mitochondria, Ribosomes and Lysosomes.
c. Golgi complex, Endoplasmic reticulum, Mitochondria and Lysosomes.
d. Endoplasmic reticulum, Mitochondria, Ribosomes and Lysosomes.

Biomolecules

59. Identify the **incorrect** pair.

a. Toxin - Abrin
b. Lectins - Concanavalin A
c. Drugs - Ricin
d. Alkaloids - Codeine

Cell Cycle and Cell Division

60. The fruit fly has 8 chromosomes (2n) in each cell. During interphase of Mitosis if the number of chromosomes at G_1 phase is 8, what would be the number of chromosomes after S phase?

a. 16   b. 4
c. 32   d. 8

61. Which stage of meiotic prophase shows terminalisation of chiasmata as its distinctive feature?

a. Zygotene   b. Diakinesis
c. Pachytene   d. Leptotene

62. The centriole undergoes duplication during:

a. Prophase   b. Metaphase
c. G_2 phase   d. S-phase

Digestion and Absorption

63. Succus entericus is referred to as:

a. Intestinal juice   b. Gastric juice
c. Chyme   d. Pancreatic juice

64. Sphincter of oddi is present at:

a. Junction of hepato-pancreatic duct and duodenum
b. Gastro-oesophageal junction
c. Junction of jejunum and duodenum
d. Ileo-caecal junction

Breathing and Exchange of Gases

65. The partial pressures (in mm Hg) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are:

a. $pO_2 = 40$ and $pCO_2 = 45$
b. $pO_2 = 95$ and $pCO_2 = 40$
c. $pO_2 = 159$ and $pCO_2 = 0.3$
d. $pO_2 = 104$ and $pCO_2 = 40$

66. Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli.

a. Low pO_2, high pCO_2, more H^+, higher temperature
b. High pO_2, high pCO_2, less H^+, higher temperature
c. Low pO_2, low pCO_2, more H^+, higher temperature
d. High pO_2, low pCO_2, less H^+, lower temperature

Body Fluids and Circulation

67. Which enzyme is responsible for the conversion of inactive fibrinogens to fibrins?

a. Renin b. Epinephrine
c. Thrombokinase d. Thrombin

68. Persons with 'AB' blood group are called as "Universal recipients". This is due to:

a. Absence of antigens A and B in plasma
b. Presence of antibodies, anti-A and anti-B, on RBCs
c. Absence of antibodies, anti-A and anti-B, in plasma
d. Absence of antigens A and B on the surface of RBCs

Locomotion and Movement

69. Chronic auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle is called as:

a. Muscular dystrophy b. Myasthenia gravis
c. Gout d. Arthritis

Chemical Coordination and Integration

70. Erythropoietin hormone which stimulates R.B.C. formation is produced by:

a. The cells of rostral adenohypophysis
b. The cells of bone marrow
c. Juxtaglomerular cells of the kidney
d. Alpha cells of pancreas.

Human Reproduction

71. Receptors for sperm binding in mammals are present on:

a. Vitelline membrane b. Perivitelline space
c. Zona pellucida d. Corona radiata

Reproductive Health

72. Match List-I with List-II.

	List-I		List-II
(A)	Vaults	(i)	Entry of sperm through Cervix is blocked
(B)	IUDs	(ii)	Removal of Vas deferens
(C)	Vasectomy	(iii)	Phagocytosis of sperms within the Uterus
(D)	Tubectomy	(iv)	Removal of fallopian tube

Choose the correct answer from the options given below.

a. A-i B-iii C-ii D-iv
b. A-ii B-iv C-iii D-i
c. A-iii B-i C-iv D-ii
d. A-iv B-ii C-i D-iii

73. Venereal diseases can spread through

A. Using sterile needles
B. Transfusion of blood from infected person
C. Infected mother to foetus
D. Kissing
E. Inheritance

Choose the correct answer from the options given below.
a. B, C and D only b. B and C only
c. A and C only d. A, B and C only

74. Which one of the following is an example of Hormone releasing IUD?

a. LNG 20 b. Cu 7
c. Multiload 375 d. CuT

Principles of Inheritance and Variation

75. In a cross between a male and female, both heterozygous for sickle cell anaemia gene, what percentage of the progeny will be diseased?

a. 75% b. 25%
c. 100% d. 50%

Molecular Basis of Inheritance

76. If Adenine makes 30% of the DNA molecule, what will be the percentage of Thymine, Guanine and Cytosine in it?

a. T : 20; G : 20; C : 30
b. T : 30; G : 20; C : 20
c. T : 20; G : 25; C : 25
d. T : 20; G : 30; C : 20

77. Which is the "Only enzyme" that has "Capability" to catalyse Initiation, Elongation and Termination in the process of transcription in prokaryotes?

a. DNA dependent RNA polymerase
b. DNA Ligase
c. DNase
d. DNA dependent DNA polymerase

78. Which of the followingh RNAs is **not** required for the synthesis of protein?

a. tRNA b. rRNA
c. siRNA d. mRNA

Strategies for Enhancement in Food Production

79. Which of the following is **not** an objective of Biofortification in crops?

a. Improve resistance of diseases
b. Improve vitamin content
c. Improve micronutrient and mineral content
d. Improve protein content

Microbes in Human Welfare

80. Match List-I with List-II.

	List-I		List-II
(A)	*Aspergillus niger*	(i)	Acetic Acid
(B)	*Acetobacter aceti*	(ii)	Lactic Acid
(C)	*Clostridium butylicum*	(iii)	Citric Acid
(D)	*Lactobacillus*	(iv)	Butyric acid

Choose the correct answer from the options given below.

a.   A-i   B-ii   C-iii   D-iv
b.   A-ii   B-iii   C-i   D-iv
c.   A-iv   B-ii   C-i   D-iii
d.   A-iii   B-i   C-iv   D-ii

Biotechnology-Principles and Processes

81. During the process of gene amplification using PCR, if very high temperature is **not** maintained in the beginning, then which of the following steps of PCR will be affected first?

a. Extension   b. Denaturation
c. Ligation   d. Annealing

82. A specific recognition sequence identified by endonucleases to make cuts at specific positions within the DNA is:

a. Okazaki sequences
b. Palindromic Nucleotide sequences
c. Poly (A) tail sequences
d. Degenerate primer sequence

Biotechnology and Its Applications

83. With regard to insulin choose correct options.

A. C-peptide is not present in mature insulin.
B. The insulin produced by rDNA technology has C-peptide.
C. The pro-insulin has C-peptide.
D. A-peptide and B-peptide of insulin are interconnected by disulphide bridges.

Choose the correct answer from the options given below.
a. B and C only   b. A, C and D only
c. A and D only   d. B and D only

84. For effective treatment of the disease, early diagnosis and understanding its pathophysiology is very important. Which of the following molecular diagnostic techniques is very useful for early detection?

a. Southern Blotting Technique
b. ELISA Technique
c. Hybridization Technique
d. Western Blotting Technique

Environmental Issues

85. Dobson units are used to measure thickness of:

a. Stratosphere   b. Ozone
c. Troposphere   d. CFCs

SECTION-B (ZOOLOGY)

Structural Organisation in Animals

86. Identify the types of cell junctions that help to stop the leakage of the substances across a tissue and facilitation of communication with neighbouring cells via rapid transfer of ions and molecules.

a. Tight junctions and Gap junctions, respectively.
b. Adhering junctions and Tight junctions, respectively.
c. Adhering junctions and Gap junctions, respectively.
d. Gap junctions and Adhering junctions, respectively.

87. Following are the statements about prostomium of earthworm.

A. It serves as a covering for mouth.
B. It helps to open cracks in the soil into which it can crawl.
C. It is one of the sensory structures.
D. It is the first body segment.

Choose the correct answer from the options given below.
a. A, B and D are correct
b. A, B, C and D are correct
c. B and C are correct
d. A, B and C are correct

Biomolecules

88. Following are the statements with reference to 'lipids'.

   A. Lipids having only single bonds are called unsaturated fatty acids.
   B. Lecithin is a phospholipid.
   C. Trihydroxy propane is glycerol.
   D. Palmitic acid has 20 carbon atoms including carboxyl carbon.
   E. Arachidonic acid has 16 carbon atoms.

   Choose the correct answer from the options given below.
   a. C and D only   b. B and C only
   c. B and E only   d. A and B only

Locomotion and Movement

89. During muscular contraction which of the following events occur?

   A. 'H' zone disappears
   B. 'A' band widens
   C. 'I' band reduces in width
   D. Myosine hydrolyzes ATP, releasing the ADP and Pi
   E. Z-lines attached to actins are pulled inwards

   Choose the correct answer from the options given below.
   a. A, B, C, D only   b. B, C, D, E only
   c. B, D, E, A only   d. A, C, D, E only

90. Match List-I with List-II.

	List-I		List-II
(A)	Scapula	(i)	Cartilaginous joints
(B)	Cranium	(ii)	Flat bone
(C)	Sternum	(iii)	Fibrous joints
(D)	Vertebral column	(iv)	Triangular flat bone

   Choose the correct answer from the options given below.

   a.   A-ii   B-iii   C-iv   D-i
   b.   A-iv   B-ii   C-iii   D-i
   c.   A-iv   B-iii   C-ii   D-i
   d.   A-i   B-iii   C-ii   D-iv

Human Reproduction

91. Which of these is **not** an important component of initiation of parturition in humans?

   a. Synthesis of prostaglandins
   b. Release of Oxytocin
   c. Release of Prolactin
   d. Increase in estrogen and progesterone ratio

92. Which of the following secretes the hormone, relaxin during the later phase of pregnancy?

   a. Corpus luteum   b. Foetus
   c. Uterus   d. Graafian follicle

Molecular Basis of Inheritance

93. **Statement I:** The codon 'AUG' codes for methionine and phenylalanine.

   Statement II: 'AAA' and 'AAG' both codons code for the amino acid lysine.

   In the light of the above statements, choose the correct answer from the options given below.

   a. Both statement I and statement II are false
   b. Statement I is correct but statement II is false
   c. Statement I is incorrect but statement II is true
   d. Both statement I and statement II are true

94. Which one of the following statement about histones is **wrong**?

   a. The pH of histones is slightly acidic.
   b. Histones are rich in amino acids - Lysine and Arginine.
   c. Histones carry positive charge in the side chain.
   d. Histones are organized to form a unit of 8 molecules.

Evolution

95. Match the following:

	List-I		List-II
(A)	Adaptive radiation	(i)	Selection of resistant varieties due to excessive use of herbicides and pesticides
(B)	Convergent evolution	(ii)	Bones of forelimbs in Man and Whale
(C)	Divergent evolution	(iii)	Wings of Butterfly and Bird
(D)	Evolution by anthropogenic action	(iv)	Darwin Finches

   Choose the correct answer from the options given below.

   a.   A-iii   B-ii   C-i   D-iv
   b.   A-ii   B-i   C-iv   D-iii
   c.   A-i   B-iv   C-iii   D-ii
   d.   A-iv   B-iii   C-ii   D-i

Human Health and Disease

96. Match the following:

List-I		List-II	
(A)	Filariasis	(i)	*Haemophilus influenzae*
(B)	Amoebiasis	(ii)	*Trichophyton*
(C)	Pneumonia	(iii)	*Wuchereria bancrofti*
(D)	Ringworm	(iv)	*Entamoeba histolytica*

Choose the correct answer from the options given below.

  a.   A-iii   B-iv   C-i   D-ii

  b.   A-i   B-ii   C-iv   D-iii

  c.   A-ii   B-iii   C-i   D-iv

  d.   A-iv   B-i   C-iii   D-ii

Strategies for Enhancement in Food Production

97. Which of the following is **not** a step in Multiple Ovulation Embryo Transfer Technology (MOET)?

  a. Cow yields about 6-8 eggs at a time
  b. Cow is fertilized by artificial insemination
  c. Fertilized eggs are transferred to surrogate mothers at 8-32 cell stage.
  d. Cow is administered hormone having LH like activity for super ovulation

Biotechnology and Its Applications

98. The adenosine deaminase deficiency results into:

  a. Parkinson's disease
  b. Digestive disorder
  c. Addison's disease
  d. Dysfunction of Immune system

Organisms and Populations

99. Match List-I with List-II:

List-I		List-II	
(A)	Allen's Rule	(i)	Kangaroo rat
(B)	Physiological adaptation	(ii)	Desert lizard
(C)	Behavioural adaptation	(iii)	Marine fish at depth
(D)	Biochemical adaptation	(iv)	Polar seal

Choose the correct answer from the options given below.

  a.   A-iv   B-i   C-iii   D-ii

  b.   A-iv   B-i   C-ii   D-iii

  c.   A-iv   B-iii   C-ii   D-i

  d.   A-iv   B-ii   C-iii   D-i

100. **Assertion (A):** A person goes to high altitude and experiences 'altitude sickness' with symptoms like breathing difficulty and heart palpitations.

Reason (R): Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.

In the light of the above statements, choose the correct answer from the options given below.

  a. Both (A) and (R) are true but (R) is not the correct explanation of (A)

  b. (A) is true but (R) is false

  c. (A) is false but (R) is true

  d. Both (A) and (R) are true and (R) is the correct explanation of (A)

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b	c	d	c	b	a	d	d	b	d	a	b	d	a	c	b	b

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
a	d	d	b	b	c	b	a	a	a	a	b	d	d	d	b	a

35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
c	a	d	b	d	b	d	c	a	c	a	a	a	d	b	b	c

52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
b	d	b	c	d	b	a	c	d	b	d	a	a	d	d	d	c

69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
b	c	c	a	a	a	b	b	a	c	a	d	b	b	b	b	b

86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
a	d	b	d	c	c	a	c	a	d	a	d	d	b	d

CHEMISTRY

SECTION-A

Some Basic Concepts of Chemistry

1. An organic compound contains 78% (by wt.) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is: [Atomic wt. of C is 12, H is 1]

a. CH_2 b. CH_3 c. CH_4 d. CH

Structure of Atom

2. A particular station of All India Radio, New Delhi, broadcasts on a frequency of 1,368 kHz (kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is:

[speed of light, $c = 3.0 \times 10^8$ ms^{-1}]

a. 219.2 m   b. 2192 m
c. 21.92 cm   d. 219.3 m

Chemical Bonding and Molecular Structure

3. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the **central atom**, respectively are:

a. sp^3 and 6   b. sp^2 and 6
c. sp^2 and 8   d. sp^3 and 4

4. Match List-I with List-II.
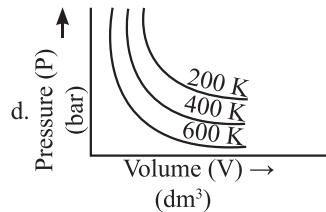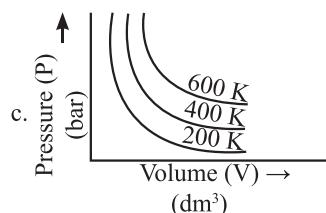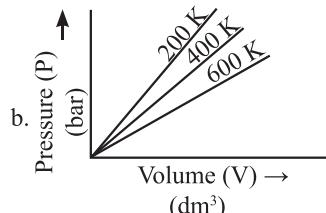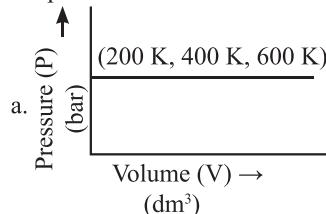
List-I		List-II	
(A)	PCl_5	(i)	Square pyramidal
(B)	SF_6	(ii)	Trigonal planar
(C)	BrF_5	(iii)	Octahedral
(D)	BF_3	(iv)	Trigonal bipyramidal

Choose the correct answer from the options given below.

a.   A-ii   B-iii   C-iv   D-i
b.   A-iii   B-i   C-iv   D-ii
c.   A-iv   B-iii   C-ii   D-i
d.   A-iv   B-iii   C-i   D-ii

States of Matter

5. Choose the **correct** option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures.

Thermodynamics

6. Which one among the following is the correct option for **right relationship** between C_P and C_V for one mole of ideal gas?

a. $C_P - C_V = R$ b. $C_P = RC_V$
c. $C_V = RC_P$ d. $C_P + C_V = R$

Equilibrium

7. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T(K). The correct option for the pH of dimethylammonium acetate solution is:

    a. 5.50　　　b. 7.75　　　c. 6.25　　　d. 8.50

Redox Reactions

8. Which of the following reactions is the metal displacement reaction? Choose the right option.

    a. $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$

    b. $Fe + 2HCl \longrightarrow FeCl_2 + H_2 \uparrow$

    c. $2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2 \uparrow$

    d. $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

Hydrogen

9. Tritium, a radioactive isotope of hydrogen, **emits** which of the following particles.

    a. Alpha (α)　　　　　　b. Gamma (γ)
    c. Neutron (n)　　　　　d. Beta (β⁻)

The s-Block Elements

10. The structures of beryllium chloride in **solid state** and **vapour** phase, are:

    a. Linear in both
    b. Dimer and Linear, respectively
    c. Chain in both
    d. Chain and dimer, respectively

11. Among the following **alkaline earth metal halides**, one which is **covalent** and **soluble** in organic solvents is:
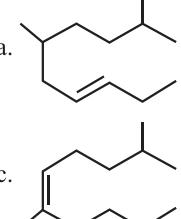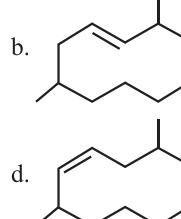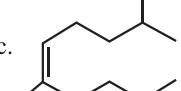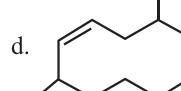
    a. Strontium chloride　　b. Magnesium chloride
    c. Beryllium chloride　　d. Calcium chloride

Organic Chemistry: Some Basic Principles and Techniques

12. The compound which shows metamerism is:

    a. C_3H_8O　　b. C_3H_6O　　c. $C_4H_{10}O$　　d. C_5H_{12}

13. The correct structure of 2,6-Dimethyl-dec-4-ene is:
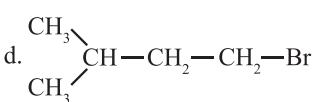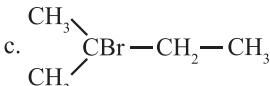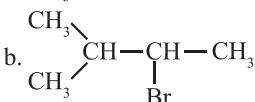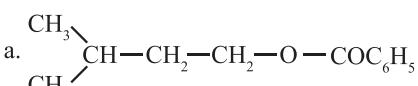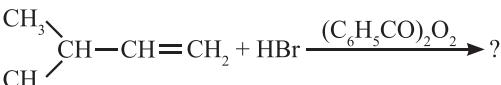
    a.

    b.

    c.

    d.

Hydrocarbon

14. Dihedral angle of **least** stable conformer of ethane is:

    a. 180°　　　b. 60°　　　c. 0°　　　d. 120°

15. The major product of the following chemical reaction is:

    $$CH_3-CH-CH=CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2} ?$$
    (with CH_3 on isopropyl group)

    a. $CH_3{-}CH{-}CH_2{-}CH_2{-}O{-}COC_6H_5$ (with CH_3 branch)

    b. $CH_3{-}CH{-}CH{-}CH_3$ with Br (with CH_3 branch)

    c. $CH_3{-}CBr{-}CH_2{-}CH_3$ (with CH_3 branch)

    d. $CH_3{-}CH{-}CH_2{-}CH_2{-}Br$ (with CH_3 branch)

The Solid State

16. Right option for the number of tetrahedral and octahedral voids in hexagonal primitive unit cell are

    a. 6, 12　　b. 2, 1　　c. 12, 6　　d. 8, 4

17. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is:

    a. 5　　　b. 2　　　c. 3　　　d. 7

Solutions

18. The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water (P_1), 10 g of urea (CH_4N_2O) in 250 ml of water (P_2) and 10 g of sucrose ($C_{12}H_{22}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is:

    a. $P_1 > P_2 > P_3$　　　　b. $P_2 > P_3 > P_1$
    c. $P_3 > P_1 > P_2$　　　　d. $P_2 > P_1 > P_3$
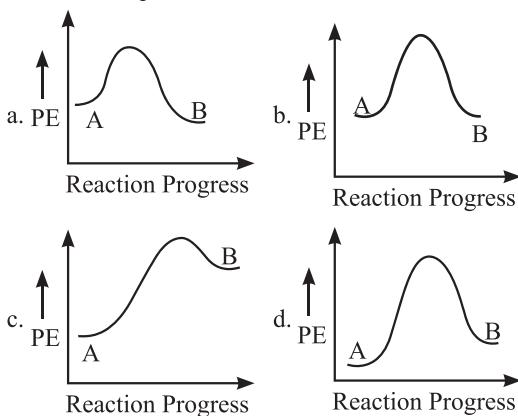
Electrochemistry

19. The molar conductance of NaCl, HCl and CH₃COONa at infinite dilution are 126.45, 426.16 and 91.0 S cm² mol⁻¹ respectively. The molar conductance of CH₃COOH at infinite dilution is. Choose the right option for your answer.

    a. 390.71 S cm² mol⁻¹　　b. 698.28 S cm² mol⁻¹
    c. 540.48 S cm² mol⁻¹　　d. 201.28 S cm² mol⁻¹

Chemical Kinetics

20. For a reaction A → B, enthalpy of reaction is –4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1}. The correct potential energy profile for the reaction is shown in option.

Surface Chemistry

21. The right option for the statement "Tyndall effect is exhibited by", is:

a. Glucose solution   b. Starch solution
c. Urea solution   d. NaCl solution

General Principles and Processes of Isolation of Elements

22. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature?

a. Chromatography   b. Distillation
c. Zone refining   d. Electrolysis

23. The maximum temperature that can be achieved in blast furnace is:

a. Upto 2200 K   b. Upto 1900 K
c. Upto 5000 K   d. Upto 1200 K

The p-Block Elements (Group 15 to 18)

24. Noble gases are named because of their inertness towards reactivity. Identify an **incorrect** statement about them.

a. Noble gases have very high melting and boiling points
b. Noble gases have weak dispersion forces
c. Noble gases have large positive values of electron gain enthalpy
d. Noble gases are sparingly soluble in water

25. Statement-I: Acid strength increases in the order given as HF << HCl << HBr << HI.

Statement II: As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.

In the light of the above statements, choose the correct answer from the options given below.

a. Both statement I and statement II are false
b. Statement I in correct but statement II is false
c. Statement I is incorrect but Statement II is true
d. Both statement I and statement II are true

The d-and f-Block Elements

26. Zr (Z = 40) and Hf (Z = 72) have **similar** atomic and ionic radii because of:

a. Diagonal relationship
b. Lanthanoid contraction
c. Having similar chemical properties
d. Belonging to same group

27. The **incorrect** statement among the following is:

a. Most of the trivalent Lanthanoid ions are colorless in the solid state
b. Lanthanoids are good conductors of heat and electricity
c. Actinoids are highly reactive metals, especially when finely divided
d. Actinoid contraction is greater for element to element that Lanthanoid contraction

Coordination Compounds

28. Ethylene diaminetetraacetate (EDTA) ion is:

a. Unidentate ligand
b. Bidentate ligand with two "N" donor atoms
c. Tridentate ligand with three "N" donor atoms
d. Hexadentate ligand with four "O" and two "N" donor atoms

Haloalkanes and Haloarenes
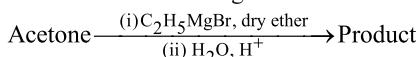
29. The correct sequence of bond enthalpy of 'C–X' bond is:

a. $CH_3 - F > CH_3 - Cl > CH_3 - Br > CH_3 - I$
b. $CH_3 - F < CH_3 - Cl > CH_3 - Br > CH_3 - I$
c. $CH_3 - Cl > CH_3 - F > CH_3 - Br > CH_3 - I$
d. $CH_3 - F < CH_3 - Cl < CH_3 - Br < CH_3 - I$

30. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This **product** formation is **based** on?

a. Hund's rule
b. Hofmann rule
c. Huckel's rule
d. Saytzeff's rule

Alcohols, Phenols and Ethers
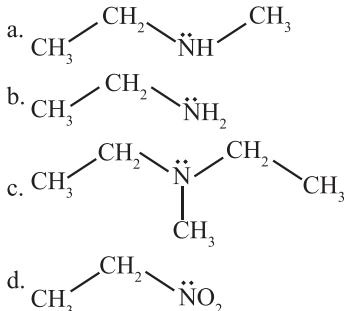
31. What is the IUPAC name of the organic compound formed in the following chemical reaction?

$$\text{Acetone} \xrightarrow[\text{(ii) } H_2O, H^+]{\text{(i)} C_2H_5MgBr, \text{ dry ether}} \text{Product}$$

a. Pentan-2-ol
b. Pentan-3-ol
c. 2-methyl butan-2-ol
c. 2-methyl propan-2-ol

Amines

32. Identify the compound that will react with Hinsberg's reagent to give a solid which dissolves in alkali.

a. $CH_3\text{—}CH_2\text{—}\ddot{N}H\text{—}CH_3$

b. $CH_3\text{—}CH_2\text{—}\ddot{N}H_2$

c. $CH_3\text{—}CH_2\text{—}\underset{\underset{CH_3}{|}}{\ddot{N}}\text{—}CH_2\text{—}CH_3$

d. $CH_3\text{—}CH_2\text{—}\ddot{N}O_2$

Biomolecules

33. The RBC deficiency is deficiency disease of:

a. Vitamin B_6
b. Vitamin B_1
c. Vitamin B_2
d. Vitamin B_{12}

Polymers

34. Which one of the following polymers is prepared by addition polymerisation?

a. Nylon-66
b. Novolac
c. Dacron
d. Teflon

Chemistry in Everyday Life

35. Given below are two statements:

Statement-I: Aspirin and Paracetamol belong to the class of narcotic analgesics.

Statement II: Morphine and Heroin are non-narcotic analgesics. In the light of the above statements, choose the correct answer from the options given below.

a. Both statement I and statement II are false
b. Statement I is correct but statement II is false
c. Statement I is incorrect but Statement II is true
d. Both statement I and statement II are true

SECTION-B

Classification of Elements & Periodicity in Properties

36. From the following pairs of ions which one is **not** an iso-electronic pair?

a. Na^+, Mg^{2+}
b. Mn^{2+}, Fe^{3+}
c. Fe^{2+}, Mn^{2+}
d. O^{2-}, F^-

Chemical Bonding and Molecular Structure

37. Which of the following molecules is non-polar in nature?

a. CH_2O
b. $SbCl_5$
c. NO_2
d. $POCl_3$

States of Matter

38. Choose the correct option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0°C is:

[Given r = 0.082 L atm mol^{-1}K^{-1}, T = 273 K]

a. 2.602
b. 25.18
c. 26.02
d. 2.518

Thermodynamics

39. For irreversible expansion of an ideal gas under isothermal condition, the correct option is:

a. $\Delta U \neq 0$, $\Delta S_{total} \neq 0$
b. $\Delta U = 0$, $\Delta S_{total} \neq 0$
c. $\Delta U \neq 0$, $\Delta S_{total} = 0$
d. $\Delta U = 0$, $\Delta S_{total} = 0$

Environmental Chemistry

40. Match List-I with List-II.

	List-I		List-II
(A)	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	(i)	Acid rain
(B)	$HOCl(g) \xrightarrow{h\nu} \overset{\bullet}{O}H + \overset{\bullet}{C}l$	(ii)	Smog
(C)	$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$	(iii)	Ozone depletion
(D)	$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$	(iv)	Tropo-spheric pollution

Choose the correct answer from the options given below.

a. A-ii B-iii C-iv D-i
b. A-iv B-iii C-i   D-ii
c. A-iii B-ii   C-iv D-i
d. A-i   B-ii   C-iii D-iv

Solutions

41. The correct option for the value of vapour pressure of a solution at 45°C with benzene to octane in molar ratio 3 : 2 is:

[At 45°C vapour pressure of benzene is 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

a. 168 mm of Hg   b. 336 mm of Hg
c. 350 mm of Hg   d. 160 mm of Hg

Electrochemistry

42. The molar conductivity of 0.007 M acetic acid is 20 S cm^2 mol^{-1}. What is the dissociation constant of acetic acid? Choose the correct option.

$$\left[\begin{array}{l} \Lambda^{\circ}_{H^+} = 350 \text{ S cm}^2\text{mol}^{-1} \\ \Lambda^{\circ}_{CH_3COO^-} = 50 \text{ S cm}^2\text{mol}^{-1} \end{array}\right]$$

a. 2.50×10^{-4} mol L^{-1} b. 1.75×10^{-5} mol L^{-1}
c. 2.50×10^{-5} mol L^{-1} d. 1.75×10^{-4} mol L^{-1}

Chemical Kinetics

43. The slope of Arrhenius Plot (ln K v/s 1/T) of first order reaction is -5×10^3 K. The value of E_a of the reaction is. Choose the correct option for your answer.

[Given R = 8.314 JK^{-1} mol^{-1}]

a. 83.0 kJ mol^{-1} b. 166 kJ mol^{-1}
c. -83 kJ mol^{-1} d. 41.5 kJ mol^{-1}

The p-Block Elements (Group 15 to 18)

44. In which one of the following arrangements the given sequence is **not** strictly according to the properties indicated against it?

a. $H_2O < H_2S < H_2Se < H_2Te$: Increasing pK$_a$ values

b. $NH_3 < PH_3 < AsH_3 < SbH_3$: Increasing acidic character

c. $CO_2 < SiO_2 < SnO_2 < PbO_2$: Increasing oxidizing power

d. $HF < HCl < HBr < HI$: Increasing acidic strength

Coordination Compounds

45. Match List-I with List-II.
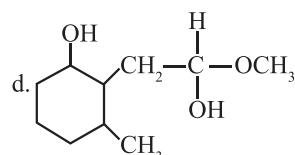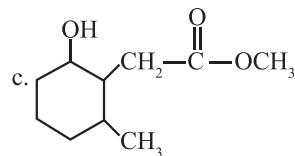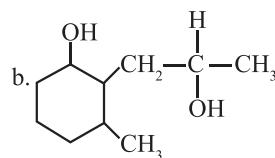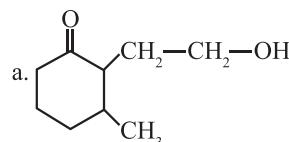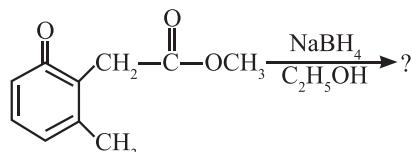
	List-I		List-II
(A)	$[Fe(CN)_6]^{3-}$	(i)	5.92 BM
(B)	$[Fe(H_2O)_6]^{3+}$	(ii)	0 BM
(C)	$[Fe(CN)_6]^{4-}$	(iii)	4.90 BM
(D)	$[Fe(H_2O)_6]^{2+}$	(iv)	1.73 BM

Choose the correct answer from the options given below.
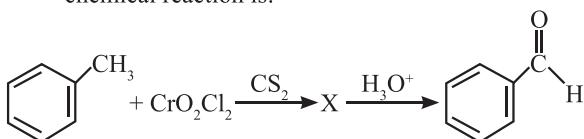
a. A-ii B-iv C-iii D-i
b. A-i   B-iii C-iv   D-ii
c. A-iv B-i   C-ii   D-iii
d. A-iv B-ii C-i   D-iii

Alcohols, Phenols and Ethers

46. The product formed in the following chemical reaction is:

a.

b.

c.

d.

47. The intermediate compound 'X' in the following chemical reaction is:

a. $CH(OCOCH_3)_2$

b. $CH{<}^{Cl}_{Cl}$

c. $CH{<}^{Cl}_{H}$

d. $CH(OCrOHCl_2)_2$

Aldehydes, Ketones and Carboxylic Acids

48. $CH_3CH_2COO^-Na^+ \xrightarrow[\text{Heat}]{\text{NaOH, +?}} CH_3CH_3 + Na_2CO_3$.
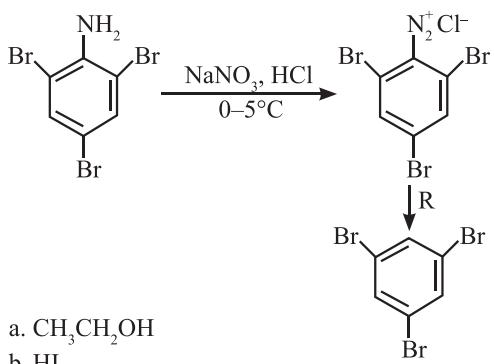
Consider the above reaction and identify the missing reagent/chemical.

a. Red Phosphorus   b. CaO
c. DIBAL-H   d. B_2H_6

49. Match List-I with List-II.

	List-I		List-II
(A)	$\xrightarrow[\text{Anhyd.}]{\text{CO, HCl}}$ $AlCl_3/CuCl$	(i)	Hell-Volhard-Zelinsky reaction
(B)	$R{-}\overset{O}{\overset{\|}{C}}{-}CH_3 +$ NaOX $\rightarrow$	(ii)	Gattermann-Koch reaction
(C)	$R - CH_2 - OH$ $+ R'COOH$ $\xrightarrow{\text{Conc. } H_2SO_4}$	(iii)	Haloform reaction
(D)	$R - CH_2COOH$ $\xrightarrow[\text{(ii) } H_2O]{\text{(i) } X_2/\text{Red P}}$	(iv)	Esterification

Choose the correct answer from the options given below.

a. A-iii   B-ii   C-i   D-iv
b. A-i   B-iv   C-iii   D-ii
c. A-ii   B-iii   C-iv   D-i
d. A-iv   B-i   C-ii   D-iii

Amines

50. The reagent 'R' in the given sequence of chemical reaction is:

a. CH_3CH_2OH
b. HI
c. CuCN/KCN
d. H_2O

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b	d	b	d	c	a	b	a	d	d	c	c	d	c	d	c	c

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
d	a	a	b	b	a	a	d	b	a	d	a	d	c	b	d	d

35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
a	c	b	b	b	b	b	b	d	a	c	c	d	b	c	a

PHYSICS

SECTION-A

Units & Measurements

1. If E and G respectively denote energy and gravitational constant, then $\dfrac{E}{G}$ has the dimensions of:
a. $[M][L^{-1}][T^{-1}]$ b. $[M][L^0][T^0]$
c. $[M^2][L^{-2}][T^{-1}]$ d. $[M^2][L^{-1}][T^0]$

2. A screw gauge gives the following readings when used to measure the diameter of a wire
Main scale reading : 0 mm
Circular scale reading : 52 divisions
Given that 1 mm on main scale corresponds to 100 divisions on the circular scale. The diameter of the wire from the above data is:
a. 0.026 cm b. 0.26 cm
c. 0.052 cm d. 0.52 cm

3. If force [F], acceleration [A] and time [T] are chosen as the fundamental physical quantities. Find the dimensions of energy.
a. [F] [A] [T²] b. [F] [A] [T⁻¹]
c. [F] [A⁻¹] [T] d. [F] [A] [T]

Laws of Motion

4. A small block slides down on a smooth inclined plane, starting from rest at time t = 0. Let S_n be the distance travelled by the block in the interval t = n – 1 to t = n. The, the ratio $\dfrac{S_n}{S_{n+1}}$ is:

a. $\dfrac{2n-1}{2n+1}$ b. $\dfrac{2n+1}{2n-1}$
c. $\dfrac{2n}{2n-1}$ d. $\dfrac{2n-1}{2n}$

Work, Energy and Power

5. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of the **input energy**. How much power is generated by the turbine? (g = 10 m/s²)
a. 8.1 kW b. 12.3 kW
c. 7.0 kW d. 10.2 kW

Gravitation

6. A particle is released from height S from the surface of the Earth. At a certain height its kinetic energy is three times its potential energy. The height from the surface of earth and the speed of the particle at that **instant** are respectively:

a. $\dfrac{S}{4}, \dfrac{\sqrt{3gS}}{2}$ b. $\dfrac{S}{2}, \dfrac{\sqrt{3gS}}{2}$

c. $\dfrac{S}{4}, \sqrt{\dfrac{3gS}{2}}$ d. $\dfrac{S}{4}, \dfrac{3gS}{2}$

7. The escape velocity from the Earth's surface is v. The escape velocity from the surface of **another** planet having a radius, four times that of Earth and same mass density is:
a. 2v b. 3v
c. 4v d. v

Mechanical Properties of Fluids

8. The velocity of a small ball of mass M and density d, when dropped in a container filled with glycerine becomes **constant** after some time. If the density of glycerine is $\dfrac{d}{2}$, then the viscous force acting on the ball will be:

a. Mg b. $\dfrac{3}{2}Mg$

c. 2 Mg d. $\dfrac{Mg}{2}$

Thermal Properties of Matter

9. A cup of coffee cools from 90°C to 80°C in t minutes, when the room temperature is 20°C. The time taken by a similar cup of coffee to cool from 80° C to 60°C at a room temperature **same** at 20°C is:

a. $\dfrac{13}{5}t$ b. $\dfrac{10}{13}t$

c. $\dfrac{5}{13}t$ d. $\dfrac{13}{10}t$

Kinetic Theory

10. Match Column-I and Column-II and choose the **correct** match from the given choices.

	Column-I		Column-II
(A)	Root mean square speed of gas molecules	(P)	$\frac{1}{3}nm\bar{v}^2$
(B)	Pressure exerted by ideal gas	(Q)	$\sqrt{\dfrac{3RT}{M}}$
(C)	Average kinetic energy of a molecules	(R)	$\frac{5}{2}RT$
(D)	Total internal energy of 1 mole of a diatomic gas	(S)	$\frac{3}{2}k_BT$

a. (A) - (Q), (B) - (R), (C) - (S), (D) - (P)
b. (A) - (Q), (B) - (P), (C) - (S), (D) - (S)
c. (A) - (R), (B) - (Q), (C) - (P), (D) - (S)
d. (A) - (R), (B) - (P), (C) - (S), (D) - (Q)

Oscillations

11. A body is executing simple harmonic motion with frequency 'n', the frequency of its potential energy is:
a. 2n
b. 3n
c. 4n
d. n

12. A spring is **stretched** by 5 cm by a force 10 N. The time period of the oscillations when a mass of 2 kg is suspended by it is:
a. 6.28 s
b. 3.14 s
c. 0.628 s
d. 0.0628 s
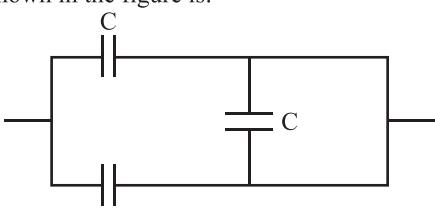
Electrostatic Potential and Capacitance

13. Two **charged** spherical conductors of radius R_1 and R_2 are connected by a wire. Then the ratio of surface charge densities of the spheres (σ_1/σ_2) is:

a. $\dfrac{R_2}{R_1}$
b. $\sqrt{\left(\dfrac{R_1}{R_2}\right)}$
c. $\dfrac{R_1^2}{R_2^2}$
d. $\dfrac{R_1}{R_2}$

14. The equivalent capacitance of the combination shown in the figure is:

a. 2C
b. C/2
c. 3C/2
d. 3C

15. A parallel plate capacitor has a uniform electric field 'E' in the space between the plates. If the distance between the plates is 'd' and the area of each plate is 'A', the energy stored in the capacitor is:
(ε_0 = permittivity of free space)

a. $\varepsilon_0 EAd$
b. $\frac{1}{2}\varepsilon_0 E^2 Ad$
c. $\dfrac{E^2 Ad}{\varepsilon_0}$
d. $\frac{1}{2}\varepsilon_0 E^2$

Current Electricity

16. In a potentiometer circuit a cell of EMF 1.5 V gives balance point at 36 cm length of wire. If another cell of EMF 2.5 V replaces the first cell, then at what length of the wire, the balance point occurs?
a. 21.6 cm
b. 64 cm
c. 62 cm
d. 60 cm

17. The effective resistance of a parallel connection that consists of four wires of equal length, equal area of cross-section and same material is 0.25 Ω. What will be the effective resistance if they are connected in series?
a. 0.5 Ω
b. 1 Ω
c. 4 Ω
d. 0.25 Ω

18. Column-I gives certain physical terms associated with flow of current through a metallic conductor. Column-II gives some mathematical relations involving electrical quantities. Match Column-I and Column-II with appropriate relations.
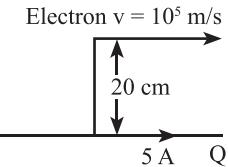
	Column-I		Column-II
(A)	Drift Velocity	(P)	$\dfrac{m}{ne^2p}$
(B)	Electrical Resistivity	(Q)	nev_d
(C)	Relaxation Period	(R)	$\dfrac{eE}{m}\tau$
(D)	Current Density	(S)	$\dfrac{E}{J}$

a. (A) - (R), (B) - (S), (C) - (Q), (D) - (P)
b. (A) - (R), (B) - (P), (C) - (S), (D) - (Q)
c. (A) - (R), (B) - (Q), (C) - (S), (D) - (P)
d. (A) - (R), (B) - (S), (C) - (P), (D) - (Q)

Moving Charges and Magnetism

19. Polar molecules are the molecules:
a. acquire a dipole moment only in the **presence** of electric field due to displacement of charges.
b. acquire a dipole moment only when magnetic field is **absent**.
c. having a **permanent** electric dipole moment.
d. having zero dipole moment.
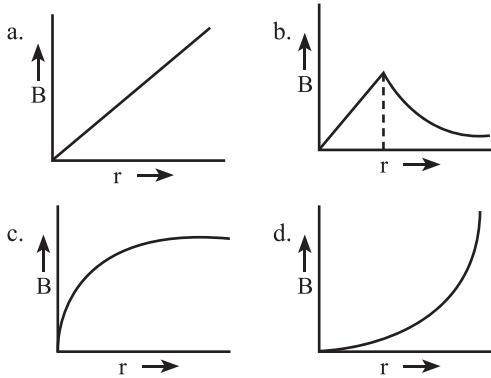
20. An **infinitely long** straight conductor carries a current of 5 A as shown. An electron is moving with a speed of 10^5 m/s parallel to the conductor. The perpendicular distance betwen the electron and the conductor is 20 cm at an instant. Calculate the magnitude of the force experienced by the electron at that instant.

Electron v = 10^5 m/s

20 cm

P   5 A   Q

a. $8\pi \times 10^{-20}$ N   b. $4\pi \times 10^{-20}$ N
c. 8×10^{-20} N   d. 4×10^{-20} N

21. A **thick** current carrying cable of radius 'R' carries current 'I' uniformly distributed across its cross-section. The variation of magnetic field B(r) due to the cable with the distance 'r' from the axis of the cable is represented by:

a.

b.

c.

d.
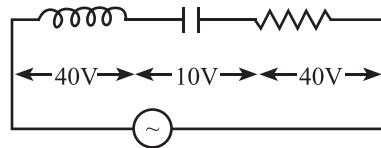
Alternating Current

22. A capacitor of capacitance 'C', is connected across an ac source of votlage V, given by $V = V_0 \sin \omega t$

The displacement current between the plates of the capacitor, would then be given by:

a. $I_d = \dfrac{V_0}{\omega C} \cos \omega t$ b. $I_d = \dfrac{V_0}{\omega C} \sin \omega t$

c. $I_d = V_0 \omega C \sin \omega t$ d. $I_d = V_0 \omega C \cos \omega t$

23. An inductor of inductance L, a capacitor of capacitance C and a resistor of resistance 'R' are connected in series to an ac source of potential difference 'V' volts as shown in figure.

Potential difference across L, C and R is 40V, 10V and 40V, respectively. The **amplitude** of current flowing through LCR series circuit is $10\sqrt{2}$ A. The impedance of the circuit is:

a. $5/\sqrt{2}\ \Omega$ b. $4\ \Omega$
c. $5\ \Omega$ d. $4\sqrt{2}\ \Omega$

Electromagnetic Waves

24. For a plane electromagnetic wave propagating in x-direction, which one of the following combination gives the **correct** possible directions for electric field (E) and magnetic field (B) respectively?

a. $-\hat{j} + \hat{k}, -\hat{j} - \hat{k}$ b. $\hat{j} + \hat{k}, -\hat{j} - \hat{k}$

c. $-\hat{j} + \hat{k}, -\hat{j} + \hat{k}$ d. $\hat{j} + \hat{k}, \hat{j} + \hat{k}$

Ray Optics and Optical Instruments

25. A lens of **large** focal length and **large** aperture is best suited as an objective of an astronomical telescope since:

a. a large aperture contributes to the quality and visibility of the images.
b. a large area of the objective ensures better light gathering power.
c. a large aperture provides a better resolution.
d. all of the above.
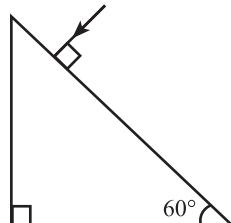
26. The number of photons per second on an average emitted by the source of monochromatic light of wavelength 600 nm, when it delivers the power of 3.3×10^{-3} watt will be: (h = 6.6×10^{-34} Js)

a. 10^{17} b. 10^{16}
c. 10^{15} d. 10^{18}

27. A convex lens 'A' of focal length 20 cm and a concave lens 'B' of focal length 5 cm are kept along the same axis with a distance 'd' between them. If a parallel beam of light falling on 'A' leaves 'B' as a parallel beam, then the distance 'd' in **cm** will be:

a. 15   b. 50
c. 30   d. 25
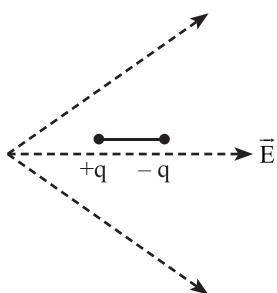
28. Find the value of the angle of emergence from the prism. Refractive index of the glass is $\sqrt{3}$.


60°

a. 30°   b. 45°
c. 90°   d. 60°

Dual Nature of Radiation and Matter

29. A <u>dipole</u> is placed in an electric field as shown. In which direction will it move?

    a. towards the **right** as its <u>potential energy</u> will **decrease**.

    b. towards the **left** as its potential energy will **decrease**.

    c. towards the **right** as its potential energy will **increase**.

    d. towards the **left** as its potential energy will **increase**.

30. An electromagnetic wave of wavelength 'λ' is incident on a photosensitive surface of **negligible** work function. If 'm' mass is of photoelectron emitted from the surface has <u>de-Broglie wavelength</u> λ_d, then:

    a. $\lambda_d = \left(\dfrac{2mc}{h}\right)\lambda^2$ b. $\lambda = \left(\dfrac{2mc}{h}\right)\lambda_d^2$

    c. $\lambda = \left(\dfrac{2h}{mc}\right)\lambda_d^{\,2}$ d. $\lambda = \left(\dfrac{2m}{hc}\right)\lambda_d^{\,2}$

Nuclei

31. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total **gain** in the <u>Binding Energy</u> in the process is:

    a. 9.4 MeV   b. 804 MeV

    c. 216 MeV   d. 0.9 MeV

32. The <u>half-life</u> of a radioactive nuclide is 100 hours. The **fraction** of original activity that will remain after 150 hours would be:

    a. $\dfrac{1}{2\sqrt{2}}$ b. $\dfrac{2}{3}$

    c. $\dfrac{2}{3\sqrt{2}}$ d. $1/2$

33. A radioactive nucleus $^{A}_{Z}X$ undergoes <u>spontaneous decay</u> in the sequence $^{A}_{Z}X \rightarrow\ _{Z-1}B \rightarrow\ _{Z-3}C \rightarrow\ _{Z-2}D$, where Z is the atomic number of element X. The possible decay particles in the **sequence** are:

    a. $\alpha,\ \beta^+,\ \beta^-$ b. $\beta^+,\ \alpha,\ \beta^-$

    c. $\beta^-,\ \alpha,\ \beta^+$ d. $\alpha,\ \beta^-,\ \beta^+$

Semiconductor Electronics

34. The electron concentration in an n-type semiconductor is the same as hole concentration in a p-type semiconductor. An external field (electric) is applied across each of them. Compare the currents in them.

    a. current in p-type > current in n-type.

    b. current in n-type > current in p-type.

    c. No current will flow in p-type, current will only flow in n-type.

    d. current in n-type = current in p-type.

35. Consider the following statements (A) and (B) and identify the correct answer.

    (A) A <u>zener diode</u> is Connected in reverse bias, when used as a voltage regulator.

    (B) The <u>potential barrier</u> of p-n junction lies between 0.1 V to 0.3 V.

    a. (A) and (B) both are incorrect.

    b. (A) is correct and (B) is incorrect.

    c. (A) is incorrect but (B) is correct.

    d. (A) and (B) both are correct.

SECTION-B

Motion in a Plane

36. A particle moving in a circle of radius R with a uniform speed takes a time T to complete one revolution.

If this particle were projected with the same speed at an angle 'θ' to the horizontal, the maximum height attained by it equals 4R. The angle of projection, θ, is then given by:

a. $\theta = \cos^{-1}\left(\dfrac{\pi^2 R}{gT^2}\right)^{1/2}$

b. $\theta = \sin^{-1}\left(\dfrac{\pi^2 R}{gT^2}\right)^{1/2}$

c. $\theta = \sin^{-1}\left(\dfrac{2gT^2}{\pi^2 R}\right)^{1/2}$

d. $\theta = \cos^{-1}\left(\dfrac{gT^2}{\pi^2 R}\right)^{1/2}$

37. A car starts from rest and accelerates at 5 m/s². At t = 4 s, a ball is dropped out of a window by a person sitting in the car. What is the velocity and acceleration of the ball at t = 6s ?
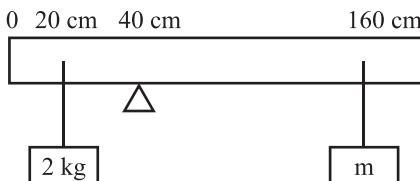
a. 20 m/s, 0

b. $20\sqrt{2}\ m/s, 0$

c. $20\sqrt{2}\ m/s, 10\,m/s^2$

d. 20 m/s, 5 m/s²

Work, Energy and Power

38. A ball of mass 0.15 kg is dropped from a height 10 m, strikes the ground and rebounds to the same height. The magnitude of impulse imparted to the ball is (g = 10 m/s²) nearly:

a. 4.2 kg m/s

b. 2.1 kg m/s

c. 1.4 kg m/s

d. 0 kg m/s

System of Particles and Rotational Motion

39. A uniform rod of length 200 cm and mass 500 g is balanced on a wedge placed at 40 cm mark. A mass of 2 kg is suspended from the rod at 20 cm and another unknown mass 'm' is suspended from the rod at 160 cm mark as shown in the figure. Find the value of 'm' such that the rod is in **equilibrium**. (g = 10 m/s²)

a. $\dfrac{1}{3}$ kg

b. $\dfrac{1}{6}$ kg

c. $\dfrac{1}{12}$ kg

d. $\dfrac{1}{2}$ kg

40. From a circular ring of mass 'M' and radius 'R' an arc corresponding to a 90° sector is removed. The moment of inertia of the **remaining part** of the ring about an axis passing through the centre of the ring and perpendicular to the plane of the ring is 'K' times 'MR²'. Then the value of 'K' is:

a. $\dfrac{7}{8}$

b. $\dfrac{1}{4}$

c. $\dfrac{1}{8}$

d. $\dfrac{3}{4}$

Gravitation

41. A particle of mass 'm' is projected with a velocity $v = kV_e$ (k < 1) from the surface of the earth.

The maximum height above the surface reached by the particle is:

a. $R\left(\dfrac{k}{1+k}\right)^2$

b. $\dfrac{R^2 k}{1+k}$

c. $\dfrac{Rk^2}{1-k^2}$

d. $R\left(\dfrac{k}{1-k}\right)^2$
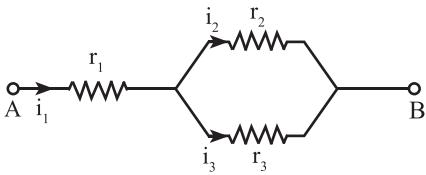
Electrostatic Potential and Capacitance

42. Twenty seven drops of same size are charged at 220 V each. They combine to form a bigger drop. Calculate the potential of the bigger drop.

a. 1320 V

b. 1520 V

c. 1980 V

d. 660 V

Current Electricity

43. Three resistors having resistances r_1, r_2 and r_3 are connected as shown in the given circuit. The ratio $\dfrac{i_3}{i_1}$ of currents in terms of resistances used in the circuit is:

a. $\dfrac{r_2}{r_2 + r_3}$

b. $\dfrac{r_1}{r_1 + r_2}$

c. $\dfrac{r_2}{r_1 + r_3}$

d. $\dfrac{r_1}{r_2 + r_3}$

Moving Charges and Magnetism

44. In the product

$$\vec{F} = q\left(\vec{v} \times \vec{B}\right)$$

$$= q\vec{v} \times \left(B\vec{i} + B\vec{j} + B_0\vec{k}\right)$$

For **q = 1** and $\vec{v} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ and

$$\vec{F} = 4\vec{i} - 20\vec{j} + 12\vec{k}$$

What will be the complete expression for $\vec{B}$?

a. $-6\hat{i} - 6\hat{j} - 8\hat{k}$

b. $8\hat{i} + 8\hat{j} - 6\hat{k}$

c. $6\hat{i} + 6\hat{j} - 8\hat{k}$

d. $-8\hat{i} - 8\hat{j} - 6\hat{k}$

Magnetism and Matter

45. A **uniform** conducting wire of length 12 a and resistance 'R' is wound up as a current carrying coil in the shape of,

i. an equilateral triangle of side 'a'.

ii. a square of side 'a'.

The magnetic dipole moments of the coil in each case respectively are:

a. $3\,Ia^2$ and Ia^2

b. $3\,Ia^2$ and $4\,Ia^2$

c. $4\,Ia^2$ and $3\,Ia^2$

d. $\sqrt{3}\,Ia^2$ and $3\,Ia^2$

Electromagnetic Induction

46. Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coinciding. If $R_1 >> R_2$, the mutual inductance M between them will be **directly proportional** to:

a. $\dfrac{R_2}{R_1}$

b. $\dfrac{R_1^2}{R_2}$

c. $\dfrac{R_2^2}{R_1}$

d. $\dfrac{R_1}{R_2}$

Alternating Current

47. A step down transformer connected to an ac mains supply of 220 V is made to operate at 11 V, 44 W lamp. **Ignoring power losses** in the transformer, what is the current in the primary circuit?
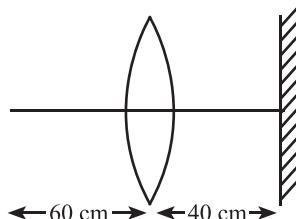
a. 0.4 A

b. 2 A

c. 4 A

d. 0.2 A

48. A series LCR circuit containing 5.0 H inductor, 80 μF capacitor and 40 Ω resistor is connected to 230 V variable frequency ac source. The angular frequencies of the source at which power transferred to the circuit is **half the power** at the resonant angular frequency are likely to be:

a. 50 rad/s and 25 rad/s

b. 46 rad/s and 54 rad/s

c. 42 rad/s and 58 rad/s

d. 25 rad/s and 75 rad/s

## Ray Optics and Optical Instruments
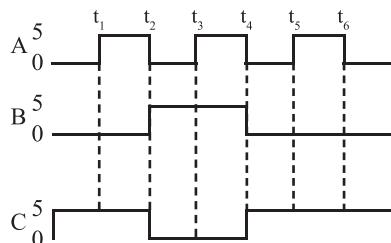
49. A point object is placed at a distance of 60 cm from a convex lens of focal length 30 cm. If a plane mirror were put perpendicular to the principal axis of the lens and at a distance of 40 cm from it, the final image would be formed at a distance of:
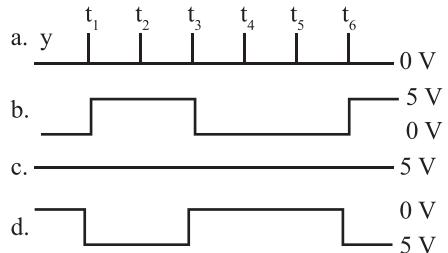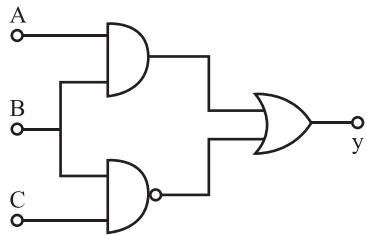

a. 30 cm from the lens, it would be a real image.

b. 30 cm from the plane mirror, it would be a virtual image.

c. 20 cm from the plane mirror, it would be a virtual image.

d. 20 cm from the lens, it would be a real image.

Semiconductor Electronics

50. For the given circuit, the input digital signals are applied at the terminals A, B and C. What would be the output at the terminal y ?

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
d	c	a	a	a	c	c	d	a	b	a	c	a	a	b	d	c

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
d	c	c	b	d	c	a	d	b	a	d	a	b	c	a	b	b

35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
b	c	c	a	c	d	c	c	a	a	d	c	d	b	c	c