

Year

2023

NEET Solved Paper

Botany

Section-A

Plant Kingdom

1. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: The first stage of gametophyte in the life cycle of moss is protonema stage.

Reason R: Protonema develops directly from spores produced in capsule.

In the light of the above statements, choose the most appropriate answer from the options given below:

- A is not correct but R is correct.
 - Both A and R are correct and R is the correct explanation of A.
 - Both A and R are correct but R is NOT the correct explanation of A.
 - A is correct but R is not correct.
2. Identify the pair of heterosporous pteridophytes among the following:
- Equisetum* and *Salvinia*
 - Lycopodium* and *Selaginella*
 - Selaginella* and *Salvinia*
 - Psilolum* and *Salvinia*

Morphology of Flowering Plants

3. Family Fabaceae differs from Solanaceae and Liliaceae. With respect to the stamens, pick out the characteristics specific to family Fabaceae but not found in Solanaceae or Liliaceae.
- Epiphyllous and Ditheous anthers
 - Diadelphous and Ditheous anthers
 - Polyadelphous and epipetalous stamens
 - Monoadelphous and Monotheous anthers
4. Axile placentation is observed in
- China rose, Petunia and Lemon
 - Mustard, Cucumber and Primorose
 - China rose, Beans and Lupin
 - Tomato, Dianthus and Pea

Anatomy of Flowering Plants

5. Given below are two statements:

Statement I: Endarch and exarch are the terms often used for describing the position of secondary xylem in the plant body.

Statement II: Exarch condition is the most common feature of the root system.

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

- Statement I is incorrect but Statement II is true.
 - Both Statement I and Statement II are true.
 - Both Statement I and Statement II are false.
 - Statement I is correct but Statement II is false.
6. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Late wood has fewer xylary elements with narrow vessels.

Reason R: Cambium is less active in winters.

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

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is NOT the correct explanation of A.
- A is true but R is false.

Biomolecules

7. Cellulose does not form blue colour with Iodine because
- It breaks down when iodine reacts with it.
 - It is a disaccharide.
 - It is a helical molecule.
 - It does not contain complex helices and hence cannot hold iodine molecules.

Cell Cycle and Cell Division

8. Among eukaryotes, replication of DNA takes place in
- G₂ phase
 - M phase
 - S phase
 - G₁ phase
9. Which of the following stages of meiosis involves division of centromere?
- Telophase
 - Metaphase I
 - Metaphase II
 - Anaphase II
10. The process of appearance of recombination nodules occurs at which sub stage of prophase I in meiosis?
- Diakinesis
 - Pachytene
 - Zygotene
 - Diplotenes

Transport in Plants

11. Movement and accumulation of ions across a membrane against their concentration gradient can be explained by
- Active Transport
 - Osmosis
 - Facilitated Diffusion
 - Passive Transport
12. Given below are two statements :

Statement I: The forces generated by transpiration can lift a xylem-sized column of water over 130 meters height.

Statement II: Transpiration cools leaf surfaces sometimes 10 to 15 degrees, by evaporative cooling.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Statement I is incorrect but Statement II is correct.
- Both Statement I and Statement II are correct.
- Both Statement I and Statement II are incorrect.
- Statement I is correct but Statement II is incorrect.

Mineral Nutrition

13. Which micronutrient is required for splitting of water molecule during photosynthesis?
- copper
 - manganese
 - molybdenum
 - magnesium

Photosynthesis in Higher Plants

14. How many ATP and NADPH, are required for the synthesis of one molecule of Glucose during Calvin cycle?
- 18 ATP and 16 NADPH₂
 - 12 ATP and 12 NADPH₂
 - 18 ATP and 12 NADPH₂
 - 12 ATP and 16 NADPH₂
15. The reaction centre in PS II has an absorption maxima at
- 780 nm
 - 680 nm
 - 700 nm
 - 660 nm

Respiration in Plants

16. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: ATP is used at two steps in glycolysis.

Reason R: First ATP is used in converting glucose into glucose-6-phosphate and second ATP is used in conversion of fructose-6- phosphate into fructose-1-6-diphosphate.

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

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A
- Both A and R are true but R is NOT the correct explanation of A.
- A is true but R is false.

Plant Growth and Development

17. Spraying of which of the following phytohormone on juvenile conifers helps in hastening the maturity period, that leads to early seed production?
- Abscisic Acid
 - Indole-3-butyric Acid
 - Gibberellic Acid
 - Zeatin
18. In tissue culture experiments, leaf mesophyll cells are put in a culture medium to form callus. This phenomenon may be called as:
- Senescence
 - Differentiation
 - Dedifferentiation
 - Development
19. Which hormone promotes internode/petiole elongation in deep water rice?
- 2, 4-D
 - GA₃
 - Kinetin
 - Ethylene

Sexual Reproduction in Flowering Plants

20. Large, colourful, fragrant flowers with nectar are seen in:
- wind pollinated plants
 - insect pollinated plants
 - bird pollinated plants
 - bat pollinated plants
21. In angiosperm, the haploid, diploid and triploid structures of a fertilized embryo sac sequentially are:
- Synergids, antipodals and Polar nuclei
 - Synergids, Primary endosperm nucleus and zygote
 - Antipodals, synergids, and primary endosperm nucleus
 - Synergids, Zygote and Primary endosperm nucleus
22. What is the function of tassels in the corn cob?
- To protect seeds
 - To attract insects
 - To trap pollen grains
 - To disperse pollen grains

Principles of Inheritance and Variation

23. The phenomenon of pleiotropism refers to
- more than two genes affecting a single character.
 - presence of several alleles of a single gene controlling a single crossover.
 - presence of two alleles, each of the two genes controlling a single trait.
 - a single gene affecting multiple phenotypic expression.
24. Frequency of recombination between gene pairs on same chromosome as a measure of the distance between genes to map their position on chromosome, was used for the first time by
- Henking
 - Thomas Hunt Morgan
 - Sutton and Boveri
 - Alfred Sturtevant

Molecular Basis of Inheritance

25. What is the role of RNA polymerase III in the process of transcription in Eukaryotes?
- Transcription of only snRNAS
 - Transcription of rRNAs (28S, 18S and 5.8S)
 - Transcription of tRNA, 5 srRNA and snRNA
 - Transcription of precursor of mRNA
26. Expressed Sequence Tags (ESTs) refers to
- Certain important expressed genes.
 - All genes that are expressed as RNA.
 - All genes that are expressed as proteins.
 - All genes whether expressed or unexpressed.
27. Unequivocal proof that DNA is the genetic material was first proposed by
- Wilkins and Franklin
 - Fedrick, Griffith
 - Alfred Hershey and Martha Chase
 - Avery, Macleoid and McCarthy

Biotechnology : Principles and Processes

28. Upon exposure to UV radiation, DNA stained with ethidium bromide will show
- Bright orange colour
 - Bright red colour
 - Bright blue colour
 - Bright yellow colour
29. In gene gun method used to introduce alien DNA into host cells, microparticles of _____ metal are used.
- Silver
 - Copper
 - Zinc
 - Tungsten or gold
30. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out
- Polysaccharides
 - RNA
 - DNA
 - Histones

Ecosystem

31. Identify the correct statements:
- Detrivores perform fragmentation
 - The humus is further degraded by some microbes during mineralization.
 - Water soluble inorganic nutrients go down into the soil and get precipitated by a process called leaching.
 - The detritus food chain begins with living organisms.
 - Earthworms break down detritus into smaller particles by a process called catabolism.

Choose the correct answer from the options given below:

- D, E, A only
 - A, B, C only
 - B, C, D only
 - C, D, E only
32. In the equation $GPP - R = NPP$
- GPP is Gross Primary Productivity
- NPP is Net Primary Productivity.
- R here is
- Reproductive allocation
 - Photosynthetically active radiation
 - Respiratory quotient
 - Respiratory loss

Biodiversity and Conservation

33. The historic Convention on Biological Diversity, 'The Earth Summit' was held in Rio de Janeiro in the year:
- 2002
 - 1992
 - 1985
 - 1986
34. Among 'The Evil Quartet', which one is considered the most important cause driving extinction of species?
- Co-extinctions
 - Habitat loss and fragmentation
 - Over exploitation for economic gain
 - Alien species invasions

Environmental Issues

35. The thickness of ozone in a column of air in the atmosphere is measured in terms of:
- Kilobase
 - Dobson units
 - Decameter
 - Decibels

Section-B

Plant Kingdom

36. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: In gymnosperms the pollen grains are released from the microsporangium and carried by air currents.

Reason R: Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.

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

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is NOT the correct explanation of A.
- A is true but R is false.

Anatomy of Flowering Plants

37. Given below are two statements: One is labelled as Assertion A and the other is labeled as Reason R:

Assertion A: A flower is defined as modified shoot wherein the shoot apical meristem changes to floral meristem.

Reason R: Internode of the shoot gets condensed to produce different floral appendages laterally at successive nodes instead of leaves.

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

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is NOT the correct explanation of A.
- A is true but R is false.

38. Identify the correct statements:

- Lenticels are the lens-shaped openings permitting the exchange of gases.
- Bark formed early in the season is called hard bark.
- Bark is a technical term that refers to all tissues exterior to vascular cambium.
- Bark refers to periderm and secondary phloem.
- Phellogen is single-layered in thickness. Choose the correct answer from the options given below:
 - B and C only
 - B, C and E only
 - A and D only
 - A, B and D only

Biomolecules

39. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of

- Dinitrogenase
- succinic dehydrogenase
- Amylase
- Lipase

Cell Cycle and Cell Division

40. Match List-I with List-II

List-I		List-II	
(A)	M 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)	Equational division

Choose the correct answer from the options given below:

- A-II, B-IV, C-I, D-III
- A-III, B-II, C-IV, D-I
- A-IV, B-II, C-I, D-III
- A-IV, B-I, C-II, D-III

Transport in Plants

41. Match List-I with List-II

List-I		List-II	
(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 option given below:

- A-II, B-I, C-IV, D-III
- A-II, B-IV, C-I, D-III
- A-IV, B-III, C-II, D-I
- A-III, B-I, C-IV, D-II

Mineral Nutrition

42. Match List-I with List-II

List-I		List-II	
(A)	Iron	(I)	Synthesis of auxin
(B)	Zinc	(II)	Component of nitrate reductase
(C)	Boron	(III)	Activator of catalase
(D)	Molybdenum	(IV)	Cell elongation and differentiation

Choose the correct answer from the options given below:

- a. A- II, B- IV, C- I, D-III b. A-III, B- II, C-I, D-IV
c. A-III, B- III, C-IV, D-I d. A-III, B-I, C-IV, D-II

Photosynthesis in Higher Plants

43. Which of the following combinations is required for chemiosmosis?

- a. proton pump, electron gradient, NADP synthase
b. membrane, proton pump, proton gradient, ATP synthase
c. membrane, proton pump, proton gradient, NADP synthase
d. proton pump, electron gradient, ATP synthase

Respiration in Plants

44. Match List-I with List-II

List-I		List-II	
(A)	Oxidative decarboxylation	(I)	Citrate synthase
(B)	Glycolysis	(II)	Pyruvate
(C)	Oxidative phosphorylation	(III)	Electron transport system
(D)	Tricarboxylic acid cycle	(IV)	EMP pathway

Choose the correct answer from the options given below:

- a. A-II, B-IV, C-III, D-I b. A-III, B-IV, C-II, D-I
c. A-II, B-IV, C-I, D-III d. A-III, B-I, C-II, D-IV

Principles of Inheritance and Variation

45. Which of the following statements are correct about Klinefelter's Syndrome?

- A. This disorder was first described by Langdon Down (1866).
B. Such an individual has overall masculine development. However, the feminine development is also expressed.
C. The affected individual is short stature.
D. Physical, psychomotor and mental development is retarded.
E. Such individuals are sterile.

Choose the correct answer from the options given below:

- a. A and E only b. A and B only
c. C and D only d. B and E only

Molecular Basis of Inheritance

46. How many different proteins does the ribosome consist of?

- a. 20 b. 80
c. 60 d. 40

Biotechnology : Principles and Processes

47. Main steps in the formation of Recombinant DNA are given below. Arrange these steps in a correct sequence

- A. Insertion of recombinant DNA into the host cell.
B. Cutting of DNA at specific location by restriction enzyme.
C. Isolation of desired DNA fragment.
D. Amplification of gene of interest using PCR.

Choose the correct answer from the option given below:

- a. B, D, A, C b. B, C, D, A
c. C, A, B, D d. C, B, D, A

Organisms and Populations

48. Given below are two statements:

Statement I: Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same related species competing for the same resources cannot co-exist indefinitely and competitively inferior one will be eliminated eventually.

Statement II: In general, carnivores are more adversely affected by competition than herbivores.

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

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

49. Match List-I with List-II

List-I (Interaction)		List-II (Species A And B)	
(A)	Mutualism	(I)	+(A), O(B)
(B)	Commensalism	(II)	-(A), O(B)
(C)	Amensalism	(III)	+(A), -(B)
(D)	Parasitism	(IV)	+(A), +(B)

Choose the correct answer from the given options:

- a. A-III, B-I, C-IV, D-II b. A-IV, B-II, C-I, D-III
c. A-IV, B-I, C-II, D-III d. A-IV, B-III, C-I, D-II

Environmental Issues

50. Which of the following answers are NOT correct?

- a. The amount of some toxic substances of industrial waste water increases in the organisms at successive trophic levels.
b. The micro-organisms involved in biodegradation of organic matter in a sewage polluted water body consume a lot of oxygen causing the death of aquatic organisms.
c. Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries.
d. Water hyacinth grows abundantly in eutrophic water bodies and leads to an imbalance in the ecosystem dynamics of the water body.

Section-A

Animal Kingdom

51. Radial symmetry is NOT found in adults of phylum
- Echinodermata
 - Ctenophora
 - Hemichordata
 - Coelenterata
52. Match List-I with List-II.

List-I		List-II	
(A)	<i>Taenia</i>	(I)	Nephridia
(B)	<i>Paramoecium</i>	(II)	Contractile vacuole
(C)	<i>Periplaneta</i>	(III)	Flame cells
(D)	<i>Pheretima</i>	(IV)	Urecoase gland

Choose the correct answer from the options give below:

- A-II, B-I, C-IV, D-III
- A-I, B-II, C-III, D-IV
- A-I, B-II, C-IV, D-III
- A-III, B-II, C-IV, D-I

Structural Organisation in Animals

53. Given below are two statements:

Statement I: Ligaments are dense irregular tissue

Statement II: Cartilage is dense regular tissue.

In the light of above statements choose the correct answer from the option given below:

- Statement I is false but Statement III is true.
- Both Statement I and II are true
- Both Statement I and II are false
- Statement I is true but Statement II is false

Cell : The Unit of Life

54. Which of the following are NOT considered as the part of endomembrane system?

- Mitochondria
- Endoplasmic Reticulum
- Chloroplasts
- Peroxisomes
- Golgi complex

Choose the most appropriate answer from the options given below:

- A, D and E only
 - B and D only
 - A, C and E only
 - A and D only
55. Which of the following functions is carried out by cytoskeleton in a cell?
- Transportation
 - Nuclear division
 - Protein synthesis
 - Motility

Biomolecules

56. Given below are two statements:

Statement I: Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

Statement II: When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor.

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

- Statement I is false but statement II is true.
- Both Statement I and Statement II are true.
- Both Statement I and Statement II are false.
- Statement I is true but Statement II is false.

57. Given below are two statements:

Statement I: A protein is imagined as a line, the left end represented by first amino acid (C-terminal) and the right end represented by last amino acid (N-terminal)

Statement II: Adult human haemoglobin, consists of 4 subunits (two subunits of α type and two subunits of β type.)

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

- Statement I is false but Statement II is true.
- Both Statement I and Statement II are true.
- Both Statement I and Statement II are false.
- Statement I is true but Statement II is false.

Digestion and Absorption

58. Match List-I with List-II.

List-I (Cells)		List-II (Secretion)	
(A)	Peptic cells	(I)	Mucus
(B)	Goblet Cells	(II)	Bile Juice
(C)	Oxyntic Cell	(III)	Proenzyme Pepsinogen
(D)	Hepatic cells	(IV)	HCl and intrinsic factor for absorption of vitamin B ₁₂

Choose the correct answer from the options given below

- A-II, B-IV, C-I, D-III
- A-IV, B-III, C-II, D-I
- A-II, B-I, C-III, D-IV
- A-III, B-I, C-IV, D-II

59. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by-
- Pyloric sphincter
 - Sphincter of Oddi
 - Ileo-caecal valve
 - Gastro-oesophageal sphincter

Breathing and Exchange of Gases

60. Vital capacity of lung is _____.
- IRV + ERV + TV
 - IRV + ERV
 - IRV + ERV + TV + RV
 - IRV + ERV + TV – RV

Body Fluids and Circulation

61. Match List-I with List-II.

List-I		List-II	
(A)	P-wave	(I)	Beginning of systole
(B)	Q-wave	(II)	Repolarisation of ventricles
(C)	QRS complex	(III)	Depolarisation of atria
(D)	T-wave	(IV)	Depolarisation of ventricles

- A-I, B-II, C-III, D-IV
- A-III, B-I, C-IV, D-II
- A-IV, B-III, C-II, D-I
- A-II, B-IV, C-I, D-III

Excretory Products and their Elimination

62. Given below are statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Nephrons are of two types: Cortical & Juxta medullary, based on their relative position in cortex and medulla.

Reason R: Juxta medullary nephrons have short loop of Henle whereas, cortical nephrons have longer loop of Henle.

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

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is NOT the correct explanation of A.
- A is true but R is false.

Locomotion and Movement

63. Match List-I with List-II.

List-I (Type of Joint)		List-II (Found between)	
(A)	Cartilaginous Joint	(I)	Between flat skull bones
(B)	Ball and Socket Joint	(II)	Between adjacent vertebrae in vertebral column

(C)	Fibrous Joint	(III)	Between carpal and metacarpal of thumb
(D)	Saddle Joint	(IV)	Between Humerus and Pectoral girdle

Choose the correct answer from the option given below:

- A-II, B-IV, C-III, D-I
- A-III, B-I, C-II, D-IV
- A-II, B-IV, C-I, D-III
- A-I, B-IV, C-III, D-II

Neural Control and Coordination

64. Match List-I with List-II with respect to human eye.

List-I		List-II	
(A)	Fovea	(I)	Visible coloured portion of eye that regulates diameter of pupil.
(B)	Iris	(II)	External layer of eye formed of dense connective tissue.
(C)	Blind spot	(III)	Point of greatest visual acuity or resolution.
(D)	Sclera	(IV)	Point where optic nerve leaves the eyeball and photoreceptor cells are absent.

Choose the correct answer from the options given below:

- A-II, B-I, C-III, D-IV
- A-III, B-I, C-IV, D-II
- A-IV, B-III, C-II, D-I
- A-I, B-IV, C-III, D-II

Chemical Coordination and Integration

65. Match List-I with List-II.

List-I		List-II	
(A)	CCK	(I)	Kidney
(B)	GIP	(II)	Heart
(C)	ANF	(III)	Gastric gland
(D)	ADH	(IV)	Pancreas

Choose the correct answer from the options given below:

- A-IV, B-II, C-III, D-I
- A-IV, B-III, C-II, D-I
- A-III, B-II, C-IV, D-I
- A-II, B-IV, C-I, D-III

Human Reproduction

66. Given below are two statements:

Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.

Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal.

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

- Statement I incorrect but Statement II is true.
- Both Statement I and Statement II are true.
- Both Statement I and Statement II are false.
- Statement I is correct but Statement II is false.

67. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Endometrium is necessary for implantation of blastocyst.

Reason R: In the absence of fertilization, the corpus luteum degenerates that causes disintegration of endometrium.

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

- A is false but R is true.
 - Both A and R are true and R is the correct explanation of A.
 - Both A and R are true but R is NOT the correct explanation of A.
 - A is true but R is false.
68. Which of the following statements are correct regarding female reproductive cycle?

- In non-primate mammals cyclical changes during reproduction are called oestrus cycle.
- First menstrual cycle begins at puberty and is called menopause.
- Lack of menstruation may be indicative of pregnancy.
- Cyclic menstruation extends between menarche and menopause.

Choose the most appropriate answer from the options given below:

- A, C and D only
- A and D only
- A and B only
- A, B and C only

Reproductive Health

69. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly?

- HIV Infection
- Genital herpes
- Gonorrhoea
- Hepatitis-B

70. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.

Reason R: Ban on amniocentesis checks increasing menace of female foeticide.

In the light of the above statements. Choose the correct answer from the options given below:

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A.
- Both A and R are true and R is NOT the correct explanation of A.
- A is true but R is false.

71. Match List-I with List-II.




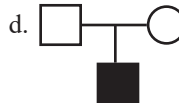
List-I		List-II	
(A)	Vasectomy	(I)	Oral method
(B)	Coitus interruptus	(II)	Barrier method
(C)	Cervical caps	(III)	Surgical method
(D)	Saheli	(IV)	Natural method

Choose the correct answer from the options given below:

- A-IV, B-II, C-I, D-III
- A-III, B-I, C-IV, D-II
- A-III, B-IV, C-II, D-I
- A-II, B-III, C-I, D-IV

Principles of Inheritance and Variation

72. Which one of the following symbols represents mating between relatives in human pedigree analysis?

- 
- 
- 
- 

73. Broad palm with single palm crease is visible in a person suffering from-

- Thalassemia
- Down's syndrome
- Turner's syndrome
- Klinefelter's syndrome

Molecular Basis of Inheritance

74. Given below are two statements:

Statement I: RNA mutates at a faster rate.

Statement II: Viruses having RNA genome and shorter life span mutate and evolve faster.

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

- Statement I false but Statement II is true.
- Both Statement I and Statement II are true.
- Both Statement I and Statement II are false.
- Statement I is true but Statement II is false.

75. Match List-I with List-II.

List-I		List-II	
(A)	Gene 'a'	(I)	β -galactosidase
(B)	Gene 'y'	(II)	Transacetylase
(C)	Gene 'i'	(III)	Permease
(D)	Gene 'z'	(IV)	Repressor protein

Choose the correct answer from the option given below:

- A-III, B-I, C-IV, D-II
- A-III, B-I, C-IV, D-III
- A-II, B-III, C-IV, D-I
- A-III, B-IV, C-I, D-II

76. Given below are two statements:

Statement I: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.

Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.

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

- Statement I is incorrect but Statement II is true.
- Both Statement I and Statement II are true.
- Both Statement I and Statement II are false.
- Statement I is correct but Statement II is false.

Evolution

77. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

- Lemur, Anteater, Wolf
- Tasmanian wolf, Bobcat, Marsupial mole
- Numbat, Spotted cuscus, Flying phalanger
- Mole, Flying squirrel, Tasmanian tiger cat

Human Health and Disease

78. Match List-I with List-II

List-I		List-II	
(A)	Ringworm	(I)	<i>Haemophilus influenzae</i>
(B)	Filariasis	(II)	<i>Trichophyton</i> .
(C)	Malaria	(III)	<i>Wuchereria bancrofti</i>
(D)	Pneumonia	(IV)	<i>Plasmodium vivax</i>

Choose the correct answer from the options given below:

- A-III, B-II, C-IV, D-I
- A-II, B-III, C-IV, D-I
- A-II, B-III, C-I, D-IV
- A-III, B-II, C-I, D-IV

79. Match List-I with List-II.

List-I		List-II	
(A)	Heroin	(I)	Effect on cardiovascular system
(B)	Marijuana	(II)	Slow down body function
(C)	Cocaine	(III)	Painkiller
(D)	Morphine	(IV)	Interfere with transport dopamine

Choose the correct answer from the options given below:

- A-III, B-IV, C-I, D-II
- A-II, B-I, C-IV, D-III
- A-I, B-II, C-III, D-IV
- A-IV, B-III, C-II, D-I

80. In which blood corpuscles, the HIV undergoes replication and produces progeny viruses?

- Eosinophils
- T_H cells
- B-lymphocytes
- Basophils

Biotechnology : Principles and Processes

81. Which of the following is not a cloning vector?

- Probe
- BAC
- YAC
- pBR322

Biotechnology and its Applications

82. Which one of the following techniques does not serve the purpose of early diagnosis of a disease for its early treatment?

- Enzyme Linked Immuno-Sorbent Assay (ELISA) technique
- Recombinant DNA Technology
- Serum and Urine analysis
- Polymerase Chain Reaction (PCR) technique

Organisms and Populations

83. Match List-I with List-II.

List-I (Interacting species)		List-II (Name of Interaction)	
(A)	A Leopard and a Lion in a forest/ grassland	(I)	Competition
(B)	A Cuckoo laying egg in a Crow's nest	(II)	Brood parasitism
(C)	Fungi and root of a higher plant in Mycorrhizae	(III)	Mutualism
(D)	A cattle egret and a Cattle in a field	(IV)	Commensalism

Choose the correct answer from the options given below:

- A-II, B-III, C-I, D-IV
- A-I, B-II, C-III, D-IV
- A-I, B-II, C-IV, D-III
- A-III, B-IV, C-I, D-II

Environmental Issues

84. Which of the following statements is correct?

- Algal Bloom decreases fish mortality.
- Eutrophication refers to increase in domestic sewage and waste water in lakes.
- Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
- Presence of large amount of nutrients in water restricts 'Algal Bloom'.

85. Given below are two statements:

Statement I: Electrostatic precipitator is most widely used in thermal power plant.

Statement II: Electrostatic precipitator in thermal power plant removes ionising radiations

In the light of the above statements, choose the most appropriate answer from the options given below:

- Statement I incorrect but Statement II is correct.
- Both Statement I and Statement II are correct.
- Both Statement I and Statement II are incorrect.
- Statement I is correct but Statement II is incorrect.

Section-B

Animal Kingdom

86. The unique mammalian characteristics are:
- pinna, monocondylic skull and mammary glands
 - hairs, tympanic membrane and mammary glands
 - hairs, pinna and mammary glands
 - hairs, pinna and indirect development
87. Select the correct statements with reference to chordates.
- Presence of a mid-dorsal, solid and double nerve cord.
 - Presence of closed circulatory system.
 - Presence of paired pharyngeal gills
 - Presence of dorsal heart
 - Triploblastic pseudocoelomate animals.
- Choose the correct answer from the options given below:
- C, D and E only
 - A, C and D only
 - B and C only
 - B, D and E only

Structural Organisation in Animals

88. Which of the following is characteristic feature of cockroach regarding sexual dimorphism?
- Presence of anal cerci
 - Dark brown body colour and anal cerci
 - Presence of anal styles
 - Presence of sclerites
89. Match List-I with List-II.

List-I		List-II	
(A)	Mast cells	(I)	Ciliated epithelium
(B)	Inner surface of bronchiole	(II)	Areolar connective tissue
(C)	Blood	(III)	Cuboidal epithelium
(D)	Tubular parts of nephron	(IV)	specialised connective tissue

- Choose the correct answer from the options
- A-III, B-IV, C-II, D-I
 - A-I, B-II, C-IV, D-III
 - A-II, B-III, C-I, D-IV
 - A-II, B-I, C-IV, D-III
90. In cockroach, excretion is brought about by-
- Phallic gland
 - Urecose gland
 - Nephrocytes
 - Fat body
 - Collateral glands

- Choose the correct answer from the options given below:
- B and D only
 - A and E only
 - A, B and E only
 - B, C and D only

Cell Cycle and Cell Division

91. Given below are two statements:
- Statement I:** During G_0 phase of cell cycle the cell is metabolically inactive
- Statement II:** The centrosome undergoes duplication during S phase of interphase.
- In the light of the above statements, choose the most appropriate answer from the option below:
- Statement I is incorrect but Statement II is correct
 - Both Statement I and Statement II are correct
 - Both Statement I and Statement II are incorrect.
 - Statement I is correct but Statement II is incorrect.
92. Select the correct statements.
- Tetrad formation is seen during leptotene
 - During Anaphase, the centromere split and chromatids separate.
 - Terminalization takes place during Pachytene.
 - Nucleolus, Golgi complex and ER are reformed during Telophase.
 - Crossing over takes place between sister chromatids of homologous
- Choose the correct answer from the option given below:
- B and E only
 - A and C only
 - B and D only
 - A, C and E only

Body Fluids and Circulation

93. Which of the following statements are correct?
- Basophils are most abundant cell of the total WBCs
 - Basophils secrete histamine, serotonin and heparin
 - Basophils are involved in inflammatory response
 - Basophils have kidney shaped nucleus
 - Basophil are agranulocyte
- Choose the correct answer from the options given below:
- A and B only
 - D and E only
 - C and E only
 - B and C only

Excretory Products and their Elimination

94. Which of the following statements are correct?
- An excessive loss of body fluid from the body switches off osmoreceptors.
 - ADH facilitates water reabsorption to prevent diuresis.
 - ANF causes vasodilation.

- D. ADH causes increase in blood pressure.
E. ADH is responsible for decrease in GFR.

Choose the correct answer from the options given below:

- a. C, D and E only b. A and B only
c. B, C and D only d. A, B and E only

Locomotion and Movement

95. Which of the following statements are correct regarding skeletal muscle?

- A. Muscle bundles are held together by collagenous connective tissue layer called fascicle.
B. Sarcoplasmic reticulum of muscle fibre is a store house of calcium ions.
C. Striated appearance of skeletal muscle fibre is due to distribution pattern of actin and myosin proteins.
D. M line is considered as functional unit of contraction called sarcomere.

Choose the most appropriate answer from the options given below:

- a. C and D only b. A, B and C only
c. B and C only d. A, C and D only

Neural Control and Coordination

96. The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are.

- a. Corpus callosum and thalamus
b. Limbic system & hypothalamus
c. Corpora quadrigemina & hippocampus
d. Brain stem & epithalamus

Chemical Coordination and Integration

97. Which of the following are NOT under the control of thyroid hormone?

- A. Maintenance of water and electrolyte balance
B. Regulation of basal metabolic rate
C. Normal rhythm of sleep-wake cycle
D. Development of immune system
E. Support the process of R.B.Cs formation
- Choose the correct answer from the options given below:

- a. D and E only b. A and D only
c. B and C only d. C and D only

Molecular Basis of Inheritance

98. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follow

5'AUCGAUCGAUCGAUCGAUCG
AUCG 3'

- a. 3' ATCGATCGATCGTCGATCG
ATCGATCG 5'
b. 5' UAGCUAGCUAGCUAGCUA
GCUAGC UAGC 3'
c. 3' UAGCUAGCUAGCUAGCUA
GCUAGCUAGC 5'
d. 5' ATCGATCGATCGATCGATCG
ATCGATCG 3'

Strategies for Enhancement in Food Production

99. Which one of the following NOT an advantage of inbreeding?
- a. It decreases the productivity of inbred population, after continuous inbreeding.
b. It decreases homozygosity.
c. It exposes harmful recessive genes that are eliminated by selection.
d. Elimination of less desirable genes and accumulation of superior genes takes place due to it

Organisms and Populations

100. Match List-I with List-II.

List-I		List-II	
(A)	Logistic growth	(I)	Unlimited resource availability condition
(B)	Exponential growth	(II)	Limited resource availability condition
(C)	Expanding age pyramid	(III)	The percent individuals of pre-reproductive age is largest followed by reproductive and post reproductive age groups
(D)	Stable age pyramid	(IV)	The percent individuals of pre-reproductives and reproductive age group are same

Choose the correct answer from the options given below:

- a. A-II, B-IV, C-III, D-I b. A-II, B-I, C-III, D-IV
c. A-II, B-III, C-I, D-IV d. A-II, B-IV, C-I, D-III

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b	c	b	a	a	b	d	c	d	b	a	b	b	c	b	b	c
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
c	d	b	d	c	d	d	c	b	c	a	d	c	b	d	b	b
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
b	d	b	c	b	d	b	d	b	a	d	b	b	d	c	c	c
52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
d	c	c	d	b	a	d	c	a	b	d	c	b	b	b	c	a
69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
c	a	c	c	b	b	c	a	c	b	b	b	a	c	b	c	d
86	87	88	89	90	91	92	93	94	95	96	97	98	99	100		
c	c	c	d	d	a	c	d	c	c	b	d	d	a	b		

Explanations

1. **(b)** Mosses spores released from the capsule germinate to form the filamentous structure called protonema. It is the first stage of gametophyte.
2. **(c)** Genera like *Selaginella* and *Salvinia* which produce two kinds of spores, macro (large) and micro (small) spores, are known as heterosporous.
3. **(b)** In fabaceae family the filaments of nine stamen are united into one bundle and tenth posterior stamen stand apart (diadelphous condition). Anther in fabaceae is of two lobes or two theca thus called dithecous anther. These two characteristics are present in the members of fabaceae family but not found in members of solanacea or liliaceae family.
Androecium: ten, diadelphous, anther dithecous
4. **(a)** In axile placentation ovules are attached to multilocular ovary as in china rose, petunia and lemon.
5. **(a)** In roots, the protoxylem lies towards periphery and metaxylem lies towards the centre. Such arrangement of primary xylem is called exarch. Endarch and exarch xylem are the terms used for primary xylem.
6. **(b)** In winter, the cambium is less active and forms fewer xylary elements that have narrow vessels, and this wood is called autumn wood or late wood.
7. **(d)** Both starch and cellulose are made of glucose molecules, but the difference between them is that starch is branched polymer while cellulose is a linear polymer. Starch also forms helical secondary structures, so it can hold I_2 molecules in the helical portion. The Starch- I_2 is blue colour. Cellulose does not contain complex helices and hence cannot hold I_2 .
8. **(c)** In eukaryotes, S or Synthesis phase marks the period during which DNA synthesis or replication takes place. During this phase the amount of DNA per cell doubles.
9. **(d)** Anaphase stage is characterised by the following key events:
 1. Centromeres split and chromatids separate.
 2. Chromatids move to opposite poles.
10. **(b)** The first two stages of prophase I are relatively short-lived compared to the next stage that is pachytene. During this stage the four chromatids of each bivalent chromosomes became distinct and clearly appears as tetrads. This stage is characterized by the appearance of recombination nodules, the site at which crossing over occurs between non-sister chromatids of the homologous chromosomes.
11. **(a)** Active transport is a type of cellular transport in which substances like ions, glucose and amino acids are transported across a biological membrane towards the region that already contains a lot of such substances. In active transport, chemical energy (eg. ATP) is used to transport such substances against the concentration gradient.
12. **(b)** A system of xylem vessels from the root to the leaf vein can supply the needed water. A pull force is created as water evaporates through stomata, and presence of water channel in the xylem elements. Presence of lower concentration of water vapour in atmosphere and higher in concentration in the substomatal cavity and intercellular spaces. These forces generated by transpiration can create pressure sufficient to lift xylem sized column of water over 130 metres high.

Apart of creating transpiration pull for absorption and transport of plants it also helps in cooling leaf surfaces, sometimes 10 to 15 degrees by evaporative cooling.

13. (b) Mn is involved in water splitting and oxygen evolving during light reaction of photosynthesis.

14. (c) In one calvin cycle

In	Out
Six CO ₂	One glucose
18 ATP	18 ADP
12 NADPH	12 NADP

15. (b) In PS I the reaction centre chlorophyll a has an absorption peak at 700 nm, hence is called P₇₀₀, while in PS II it has absorption maxima at 680 nm, and is called P₆₈₀.

16. (b) ATP is utilised at two steps: first in the conversion of glucose into glucose 6-phosphate and second in the conversion of fructose 6-phosphate to fructose 1, 6-bisphosphate.

17. (c) Spraying of gibberellins on juvenile conifers, hastens the maturity period and thus leading to early seed production.

18. (c) The living differentiated cells, that by now have lost the capacity to divide can regain the capacity of division under certain conditions. This phenomenon is termed as dedifferentiation. Same occurs in tissue culture of leaf.

19. (d) Ethylene promotes rapid internode/petiole elongation in deep water rice plants.

20. (b) Majority of insect-pollinated flowers are large, colorful, fragrant flowers and rich in nectar. These characteristics off were attract insect and thus help in pollination.

21. (d) In angiosperms, the haploid diploid and triploid structure of a fertilised embryo sac sequentially are-

Synergids, Zygote and Primary endosperm nucleus

22. (c) Wind pollinated flower eg. *Zea mays* (maize) have non-essential whorls such as calyx, corolla, bracts and bracteoles are not showy. Flowers are devoid of scent and nectar. The tessels represent the stigma and style. Pollen grains are dry, very small sized, non-sticky and unwettable, so that they can be carried by wind to the long distances. Stigma is hairy, feathery that catches the wind borne pollens.

23. (d) Generally effect of a gene can be seen on a single phenotype of a trait. However, there are instances where a single gene can exhibit multiple phenotype expression. Such a gene is called a pleiotropic gene.

24. (d) Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes and 'mapped' their position on the chromosome.

25. (c) In eukaryotes, The RNA polymerase I transcribes rRNAs (28S, 18S, and 5.8S), whereas the RNA polymerase III is responsible for transcription of tRNA, 5srRNA, and snRNAs (small nuclear RNAs). The RNA polymerase II transcribes precursor of mRNA, the heterogeneous nuclear RNA (hnRNA).

26. (b) All the genes that are expressed as RNA are referred to as Expressed sequence Tags (EST) are focussed on identifying all the genes that are expressed as RNA.

27. (c) The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952). They worked with virus that inject bacteria called bacteriophages.

28. (a) In gel electrophoresis the separated DNA fragments can be visualized only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. Bright orange coloured bands of DNA can be seen when stained with ethidium bromide and exposed to UV light.

29. (d) A biolistic or gene gun is a technique of genetic engineering where the genes, DNA, RNA or proteins are transferred to the plant cells without the use of any vectors. The genetic material is coated with heavy metal i.e. gold or tungsten bombarded with the heavy velocity.

30. (c) Addition of chilled ethanol precipitates the genomic DNA during the isolation of DNA or genetic material.

31. (b) Detritus food chain (DFC) begins with detritus or dead organic matter. Detrivores (eg. Earthworm, millipeds, slugs) perform fragmentation process on dead decaying material in any ecosystem. Humus a dark nutrient rich substance is degraded by microorganisms releasing inorganic nutrients into the soil. This process is known as mineralization. By the process leaching, water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.

32. (d) Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP)

33. (b) The historic Convention on Biological Diversity ('The Earth Summit') held in Rio de Janeiro in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.

34. (b) There are four major causes of biodiversity losses (The Evil Quartet) that are habitat loss and fragmentation, over-exploitation, Alien species invasion and co-extinctions. Habitat loss and fragmentation is the most important cause driving animals and plants to extinction.

35. (b) The thickness of the ozone in a column of air from the ground to the top of the atmosphere is measured in terms of Dobson units (DU).

- 36. (d)** In gymnosperms, the pollen grain is released from the microsporangium. They are carried in air currents and come in contact with the opening of the ovules borne on megasporophylls. The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.
- 37. (b)** A flower is a modified shoot wherein the shoot apical meristem changes to floral meristem. Internodes do not elongate and the axis gets condensed. The apex produces different kinds of floral appendages laterally at successive nodes instead of leaves.
- 38. (c)** Bark is a non-technical term that refers to all tissues exterior to the vascular cambium, therefore including secondary phloem. Bark refers to a number of tissue types, viz., periderm and secondary phloem. Bark that is formed early in the season is called early or soft bark. Towards the end of the season, late or hard bark is formed. Lenticels permit the exchange of gases between the outer atmosphere and the internal tissue of the stem. Meristematic tissue called cork cambium or phellogen develops, usually in the cortex region. Phellogen is a couple of layers thick.
- 39. (b)** The competitive inhibitor competes with the substrate for the substrate binding site of the enzyme. Consequently, the substrate cannot bind and as a result, the enzyme action declines, e.g. inhibition of succinic dehydrogenase by malonate which closely resembles the substrate succinate in structure. Such competitive inhibitors are often used in the control of bacterial pathogens.
- 40. (d)** M phase is most dramatic period of cell cycle also called equational division.
- G₂ phase:** Proteins are synthesized in preparation for mitosis.
- Quiescent stage:** cell do not divide further exit G₁ phase to enter an inactive state.
- G₁ phase:** This phase corresponds to the interval between mitosis and initiation of DNA replication.
- 41. (b) Cohesion:** Mutual attraction between water molecules.
- Adhesion:** Attraction of water molecules to polar surfaces.
- Surface Tension:** Water molecules are attracted to each other in the liquid phase more than to water in the gas phase.
- Guttation:** Water loss in its liquid phase near the tip of grass blades.
- 42. (d) Iron:** It activates catalase enzyme, and is essential for the formation of chlorophyll.
- Zinc:** It needed in the synthesis of auxin.
- Boron:** It required for uptake and utilisation of Ca²⁺, cell elongation, cell differentiation, membrane functioning, Pollen germination and carbohydrate translocation.
- Molybdenum:** It is component of several enzymes, including nitrogenous and nitrate reductase.
- 43. (b)** Chemiosmosis requires a membrane, a proton pump, a proton gradient and ATP synthase.
- Energy is used to pump protons across a membrane, to create a gradient or a high concentration of protons within the thylakoid lumen. ATP synthase has a channel that allows diffusion of protons back across the membrane; this releases enough energy to activate ATP synthase enzyme that catalyses the formation of ATP.
- 44. (a)** Pyruvate when enters into mitochondrial matrix, it undergoes oxidative decarboxylation by a complex set of reactions catalysed by pyruvic dehydrogenase.
- Glycolysis often referred to as the EMP pathway.
- Oxidative phosphorylation in process embedded in inner membrane of mitochondria (called electron transport chain and ATP synthase). The reaction in TCA cycle catalysed by the enzyme citrate synthase.
- 45. (d)** Klinefelter's Syndrome is a genetic disorder that also caused due to the presence of an additional copy of X chromosome resulting into a karyotype of 47, XXY. Such an individual has overall masculine development, however, the feminine development (development of breast, i.e., Gynaecomastia) is also expressed. Such individuals are sterile.
- Down syndrome was first described by Langdon down (1866). In this disorder affected individual is physically, psychomotorly and mentally retarded.
- 46. (b)** The cellular factory responsible for synthesising proteins is the ribosome. The ribosome consists of structural RNAs and about 80 different proteins.
- 47. (b)** Main steps in the formation of recombinant DNA in correct sequence are:
- B:** Cutting of DNA at specific location by restriction enzyme.
- C:** Isolation of desired DNA fragment by electrophoresis.
- D:** Amplification of gene of interest using PCR.
- A:** Insertion of recombinant DNA into the host cell.
- 48. (d)** Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.
- In general, herbivores and plants appear to be more adversely affected by competition than carnivores.
- 49. (c) Mutualism:** This interaction confers benefits on both the interacting species.
- Commensalism:** This is the interaction in which one species benefit (+) and other in neutral (o).

Amensalism: In this interaction one species is harmed (–) whereas the other is unaffected (o).

Parasitism: In this interaction one species benefit (+) and other is harmed (–).

50. (c) Presence of large amounts of nutrients in waters causes excessive growth of planktonic algae called an algal bloom which imparts a distinct colour to the water bodies. Algal blooms cause deterioration of the water quality and fish mortality. Some bloom forming algae are extremely toxic to human beings and animals.

51. (c) Radial symmetry: When any plane passing through the central axis of the body divides the organism into two identical halves.

Bilateral symmetry: When the body can be divided into identical left and right halves in only one plane.

The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

Coelenterates and Ctenophores are radially symmetrical animals.

Hemichordates are bilaterally symmetrical animals.

52. (d) Flatworms (e.g., *Taenia*) have excretory systems called protonephridia with flame cells.

Freshwater *Paramecium* have osmoregulatory organelle called contractile vacuole. Urease glands in Cockroaches (*Periplaneta*) helps in excretion. In earthworms (*Pheretima*), the excretory organs are nephridia.

53. (c) Ligaments are dense regular connective tissue that connect bone to bone. Cartilage is one of the types of specialised connective tissues.

54. (c) The endomembrane system include endoplasmic reticulum (ER), golgi complex, lysosomes and vacuoles. Since the functions of the mitochondria, chloroplast and peroxisomes are not coordinated with the above components, these are not considered as part of the endomembrane system.

55. (d) The cytoskeleton in a cell are involved in many functions such as mechanical support, motility, maintenance of the shape of the cell.

56. (b) Both statements, I and II are correct. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat. When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor. Due to its close structural similarity with the substrate, the inhibitor competes with the substrate for the substrate binding site of the enzyme. Consequently, the substrate cannot bind and as a result, the enzyme action declines, e.g., inhibition of succinic

dehydrogenase by malonate which closely resembles the substrate succinate in structure.

57. (a) Statement I is incorrect as the first amino acid is called as N-terminal amino acid and the last amino acid is called the C-terminal amino acid.

58. (d) Peptic cells – Secrete the proenzyme pepsinogen.

Goblet cells – Secrete mucus.

Oxyntic cells – Secrete HCl and intrinsic factor needed for the absorption of Vitamin B₁₂.

Hepatic cells – Secrete bile which is stored and concentrated in the gall bladder.

59. (c) The undigested, unabsorbed substances called faeces enters into the caecum of the large intestine through ileo-caecal valve, which prevents the back flow of the faecal matter. It is temporarily stored in the rectum till defaecation.

60. (a) Vital Capacity (VC): The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration.

61. (b) In an ECG record, three recognisable waves (P-wave, QRS complex and T-wave) appear with each heartbeat.

P-wave – represents atrial depolarisation.

QRS complex – represents ventricular depolarisation.

T-wave – represents ventricular repolarisation.

Q-wave – represents initial phase of ventricular depolarisation i.e., beginning of systole.

62. (d) In majority of nephrons, the loop of Henle is too short and extends only very little into the medulla. Such nephrons are called cortical nephrons. In some of the nephrons, the loop of Henle is very long and runs deep into the medulla. These nephrons are called juxta medullary nephrons.

63. (c) Cartilaginous Joints – Between adjacent vertebrae in vertebral column.

Ball and socket Joint – Between humerus and pectoral girdle.

Fibrous Joint – Between flat skull bones.

Saddle Joint – Between carpal and metacarpal of thumb.

64. (b) The fovea is a thinned-out portion of the retina where only the cones are densely packed. It is the point where the visual acuity (resolution) is the greatest. The visible colored portion of the eye is iris. The diameter of the pupil is regulated by the muscle fibres of iris. Blind spot contains no photoreceptor cells. It is also a region where the optic nerves leave the eye and the retinal blood vessels enter it. The external layer of an eyeball is composed of a dense connective tissue and is called the sclera.

65. (b) Cholecystokinin (CCK), a hormone secreted by I-cells of the upper small intestine. It acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice, respectively.

Gastric inhibitory peptide (GIP) is secreted by K-cells of the small intestine. It acts to decrease gastrin and gastrin dependent acid secretion from the parietal cells of the stomach (gastric glands).

Atrial natriuretic factor (ANF) is a peptide hormone secreted by atrial wall of our heart. It decreases blood pressure.

Anti-diuretic hormone (ADH) causes the kidneys to return more water to the blood and thus decrease the urine volume.

66. (b) Each ejaculatory duct is formed by the union of the duct from the seminal vesicle and the vas deferens. They opens into the prostatic urethra.

Cervical canal (interior of the cervix) along with vagina forms the birth canal.

67. (c) Both assertion and reason are correct but reason is not correct explanation why endometrium is necessary for implantation of blastocyst. The attachment of a blastocyst to the endometrium is called the implantation. It occurs about 6 days after fertilisation. The endometrium is necessary for implantation as it serves as a key place not only for supporting foetal growth through supplementation of oxygen and nutrients but also for protecting the embryo and later the foetus from microbial invasion during pregnancy.

If fertilisation does not occur, the levels of progesterone and estrogens decline due to degeneration of the corpus luteum. Withdrawal of progesterone and estrogens causes disintegration of the endometrium leading to menstruation.

68. (a) All options are correct except option B. First menstrual cycle begins at puberty is called menarche, not menopause.

69. (c) Gonorrhoea is a sexually transmitted disease (STD) caused by the infection with bacterium *Neisseria gonorrhoeae*. Gonorrhoea can be cured with the proper treatment if detected early. HIV infections, genital herpes and hepatitis-B are incurable STDs.

70. (a) Amniocentesis involves removal of some of the amniotic fluid that bathes the developing foetus and analysing the foetal cells and dissolved substances. It can be done to detect genetic disorders, chromosomal abnormalities, biochemical defects, etc. It can also reveal a baby's gender. Statutory ban on amniocentesis for sex-determination have been done to legally check increasing menace of female foeticides. Its application of sex determination is not one of the strategies of Reproductive and Child Health Care Programme.

71. (c) Vasectomy is a surgical method of contraception in males. In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum. Although sperm production continues in the testes, sperm can no longer reach the exterior. The sperm degenerate and are destroyed by phagocytosis.

Withdrawal or coitus interruptus is one of the natural methods of contraception in which the male partner withdraws his penis from the vagina just before ejaculation so as to avoid insemination.

Cervical caps are barriers that fit snugly over the cervix and block sperm from entering the uterus.

Saheli –the new oral contraceptive for the females contains a non-steroidal preparation. It is a 'once a week' pill with very few side effects and high contraceptive value.

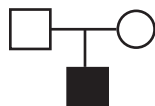
72. (c) ■ ● ◆ Affected individuals



Mating



Mating between relatives (consanguineous mating)



Parents with male child affected with disease

73. (b) Down's Syndrome : The cause of this genetic disorder is the presence of an additional copy of the chromosome number 21 (trisomy of 21). This disorder was first described by Langdon Down (1866). The affected individual is short statured with small round head, furrowed tongue and partially open mouth. Palm is broad with characteristic palm crease. Physical, psychomotor and mental development is retarded.

74. (b) RNA mutates at a faster rate because it is unstable. Therefore, viruses having RNA genome and shorter life span allow them to mutate and evolve at faster rates.

75. (c) The *lac* operon consists of one regulatory gene (the *i* gene – here the term *i* does not refer to inducer, rather it is derived from the word inhibitor) and three structural genes (*z*, *y*, and *a*). The *i* gene codes for the repressor of the *lac* operon. The *z* gene codes for beta-galactosidase (β -gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose. The *y* gene codes for permease, which increases permeability of the cell to β -galactosides. The *a* gene encodes a transacetylase.

76. (a) In prokaryotes, such as, *E. coli*, though they do not have a defined nucleus, the DNA is not scattered throughout the cell. DNA (being negatively charged) is held with some proteins (that have positive charges) in a region termed as 'nucleoid'. The DNA in nucleoid is organised in large loops held by proteins.

77. (c) The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation. Australian marsupials exhibit this phenomenon and gave varieties of marsupials, e.g., Numbat, Spotted cuscus, Flying phalanger, etc.
78. (b) Ringworm – *Trichophyton*
 Filariasis – *Wuchereria bancrofti*
 Malaria – *Plasmodium vivax*
 Pneumonia – *Haemophilus influenzae*
79. (b) Heroin is a depressant and slows down body functions. Use of marijuana causes increased heartbeat and blood pressure (cardiovascular effects). Cocaine interferes with the transport of dopamine and causes build up of dopamine in the synapses. Morphine is a very effective sedative and painkiller.
80. (b) HIV enters into helper T-lymphocytes (T_H), replicates and produce progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes
81. (a) A probe is not a cloning vector rather it is a single-stranded sequence of DNA or RNA used to search for its complementary sequence in a sample genome.
82. (c) Of these, serum and urine analysis does not fulfil the purpose of early diagnosis of a disease. In early stages of infections, when the disease symptoms are not visible, amplification of pathogenic nucleic acid can be done by PCR, detection of antibodies produced by host against pathogen by ELISA and rDNA technology can serve the purpose of early diagnosis.
83. (b) Competition is a -/- interaction that occurs when individuals of different species compete for a resource that limits the survival and reproduction of each species, e.g., a leopard and a lion in a forest or grassland.
- Brood parasitism or the laying of one's eggs in the nest of another individual, is a reproductive strategy whereby parasites foist the cost of rearing their offspring onto another individual, the host, e.g., a cuckoo laying eggs in a crow's nest.
- Mutualism is an interspecific interaction that benefits both species (+/+), e.g., fungi and roots of a higher plant in mycorrhizae.
- Commensalism is the interaction in which one species benefits and the other is neither harmed nor benefited, e.g., a cattle egret and a cattle in a field.
84. (c) Algal blooms cause deterioration of the water quality and fish mortality. Eutrophication is the natural aging of a lake by nutrient enrichment of its water. Presence of large amounts of nutrients in waters also causes excessive growth of planktonic (free-floating) algae, called an algal bloom.
85. (d) There are several ways of removing particulate matter; the most widely used of which is the electrostatic precipitator, which can remove over 99 per cent particulate matter present in the exhaust from a thermal power plant.
86. (c) The most unique mammalian characteristic is the presence of mammary gland (milk producing glands), skin possessing hair and presence of external ear or pinnae.
87. (c) Phylum Chordata are characterised by the presence of a notochord, a dorsal hollow nerve cord, and paired pharyngeal gill slits. These are triploblastic, coelomate with organ-system level of organisation. Vertebrates have a ventral muscular heart with two, three or four chambers.
88. (c) Anal styles are paired, short, unjointed structure present only in male and help in sexual dimorphism.
89. (d) Mast cells – Areolar tissue serve as support frame work for epithelium.
- Inner surface of Bronchiole – Ciliated epithelium bear cilia on their free surface that help to move particles in specific direction.
- Blood – Specialised connective tissues.
- Tubular parts of nephrons – Cuboidal epithelium help in secretion and absorption.
90. (d) Insects like cockroach are uricotelic (excrete uric acid). In addition, the fat body, nephrocytes and urecose glands also help in excretion.
91. (a) The cells that do not divide further exit G_1 phase to enter an inactive stage called quiescent stage (G_0) of the cell cycle. Cells in this stage remain metabolically active but no longer proliferate unless called on to do so depending on the requirement of organism.
92. (c) Tetrad formation is seen during zygotene. The final stage of meiotic prophase I is diakinesis. This is marked by terminalisation of chiasmata. Crossing over occurs between non-sister chromatids of the homologous chromosomes.
93. (d) Neutrophils are the most abundant cells (60-65%) of the total WBCs and basophils are the least (0.5-1%). Basophils have S-shaped nucleus. Neutrophils, eosinophils and basophils are different types of granulocytes.
94. (c) An excessive loss of fluid from the body can activate osmoreceptors which stimulate the hypothalamus to release ADH. Hence, switch on osmoreceptors.
- ADH cause an increase in blood pressure. An increase in blood pressure can increase the glomerular blood flow and thereby the GFR.

- 95. (c)** Fascicle (Muscle bundles) are formed by many muscle fibres and covered by perimysium and all of it held by epimysium. The thick filaments in A-band are also held together in the middle of this band by a thin fibrous membrane called M-line.
- 96. (b)** Inner parts of cerebral hemispheres and a group of associated deep structures like amygdala, hippocampus etc., form a complex structure called limbic system. Limbic system along with the hypothalamus, it is involved in the regulation of sexual behaviour, expression of emotional reactions (e.g., excitement, pleasure, rage and fear), and motivation.
- 97. (d)** Thyroid hormones play an important role in the regulation of the basal metabolic rate. These hormones also support the process of red blood cell formation. Thyroid hormones control the metabolism of carbohydrates, proteins and fats. Maintenance of water and electrolyte balance is also influenced by thyroid hormones. Thyroid gland also secretes a protein hormone called thyrocalcitonin (TCT) which regulates the blood calcium levels. Melatonin plays a very important role in regulation of system of our body. It maintain sleep wake cycle, body temperature, etc. Thymus helps in development of the immune system.
- 98. (d)** The two strands have opposite polarity and the DNA-dependent RNA polymerase also catalysed the polymerisation in only one direction, i.e., 5'-3', The strand that has the polarity 3' - 5' acts a template, and is also referred to as template strand. The other stand which has polarity (5'- 3') and the sequence same as RNA (except thymine at the place of uracil), is displaced during transcription. This strand is referred to as coding strand.
- 99. (a)** The selection of desirable genes at each steps increases the productivity of inbred population. However, continued inbreeding, especially close inbreeding, usually reduces fertility and even productivity, Hence referred as inbreeding depression.
- 100. (b)** Logistic growth – A population growing in a habitat with limited resources.
- Exponential growth – Any species growing exponentially under unlimited resource conditions can reach enormous population densities in a short time.
- Expanding age pyramids – The percent individuals of pre-reproductive age is largest followed by reproductive and post reproductive age groups.
- Stable age pyramid – The percent individuals of pre-reproductives and reproductive age group are same.
-



NEET Solved Paper

Section-A

Units and Measurements

- The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are:
 - Random errors
 - Instrumental errors
 - Personal errors
 - Least count errors
- A metal wire has mass (0.4 ± 0.002) g, radius (0.3 ± 0.001) mm and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be :
 - 1.4%
 - 1.2%
 - 1.3%
 - 1.6%

Motion in a Straight Line

- A vehicle travels half the distance with speed v and the remaining distance with speed $2v$. Its average speed is:
 - $\frac{3v}{4}$
 - $\frac{v}{3}$
 - $\frac{2v}{3}$
 - $\frac{4v}{3}$

Motion in a Plane

- A football player is moving southward and suddenly turns eastward with the same speed to avoid an opponent. The force that acts on the player while turning is:
 - along south-west
 - along eastward
 - along northward
 - along north-east
- A bullet is fired from a gun at the speed of 280 m/s in the direction 30° above the horizontal. The maximum height attained by the bullet is
($g = 9.8 \text{ ms}^{-2}$, $\sin 30^\circ = 0.5$)
 - 3000 m
 - 2800 m
 - 2000 m
 - 1000 m

Work, Energy and Power

- The potential energy of a long spring when stretched by 2 cm is U . If the spring is stretched by 8 cm, potential energy stored in it will be:
 - 16U
 - 2U
 - 4U
 - 8U

System of Particles & Rotational Motion

- The angular acceleration of a body, moving along the circumference of a circle, is:
 - along the axis of rotation
 - along the radius, away from centre
 - along the radius towards the centre
 - along the tangent to its position
- The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of same mass and radius about its axis is:
 - 5 : 2
 - 3 : 5
 - 5 : 3
 - 2 : 5

Gravitation

- Two bodies of mass m and $9m$ are placed at a distance R . The gravitational potential on the line joining the bodies where the gravitational field equals zero, will be ($G =$ gravitational constant):
 - $-\frac{20Gm}{R}$
 - $-\frac{8Gm}{R}$
 - $-\frac{12Gm}{R}$
 - $-\frac{16Gm}{R}$

Mechanical Properties of Solid

10. Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is:

- a. Zero
 b. $\frac{2W}{A}$
 c. $\frac{W}{A}$
 d. $\frac{W}{2A}$

Mechanical Properties of Fluid

11. The amount of energy required to form a bubble of radius 2 cm from a soap solution is nearly: (surface tension of soap solution = 0.03 N m^{-1})

- a. $50.1 \times 10^{-4} \text{ J}$
 b. $30.1 \times 10^{-4} \text{ J}$
 c. $5.06 \times 10^{-4} \text{ J}$
 d. $3.01 \times 10^{-4} \text{ J}$

12. The venturi-meter works on:

- a. The principle of perpendicular axes
 b. Huygen's principle
 c. Bernoulli's principle
 d. The principle of parallel axes

Thermodynamics

13. A Carnot engine has an efficiency of 50% when its source is at a temperature 327°C . The temperature of the sink is:

- a. 200°C
 b. 27°C
 c. 15°C
 d. 100°C

Kinetic Theory

14. The temperature of a gas is -50°C . To what temperature the gas should be heated so that the rms speed is increased by 3 times?

- a. 223 K
 b. 669°C
 c. 3295°C
 d. 3097 K

Waves

15. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of a closed pipe having the same length is

- a. 3 : 1
 b. 1 : 2
 c. 2 : 1
 d. 1 : 3

Electric Charges and Fields

16. An electric dipole is placed at an angle of 30° with an electric field of intensity $2 \times 10^5 \text{ NC}^{-1}$. It experiences a torque equal to 4 Nm. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm.

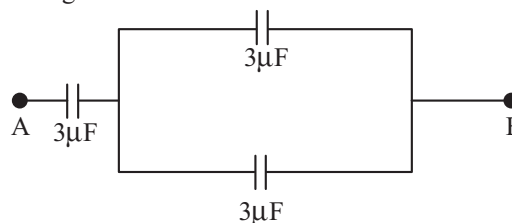
- a. 2 mC
 b. 8 mC
 c. 6 mC
 d. 4 mC

17. If $\oint_s \vec{E} \cdot d\vec{S} = 0$ over a surface, then:

- a. the electric field inside the surface is necessarily uniform.
 b. the number of flux lines entering the surface must be equal to the number of flux lines leaving it.
 c. the magnitude of electric field on the surface is constant.
 d. all the charges must necessarily be inside the surface.

Electrostatic Potential and Capacitance

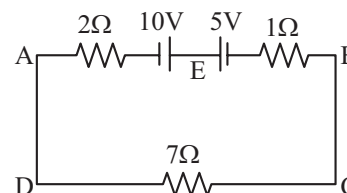
18. The equivalent capacitance of the system shown in the following circuit is:



- a. 9 μF
 b. 2 μF
 c. 3 μF
 d. 6 μF

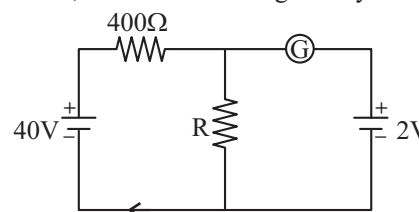
Current Electricity

19. The magnitude and direction of the current in the following circuit is



- a. 1.5 A from B A through E
 b. 0.2 A from B to A through E
 c. 0.5 A from A to B through E
 d. $\frac{5}{9}$ A from A to B through E

20. If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by:



- a. 400 Ω
 b. 200 Ω
 c. 50 Ω
 d. 100 Ω

21. Resistance of a carbon resistor determined from colour codes is $(22000 \pm 5\%) \Omega$. The colour of third band must be:

- a. Yellow
 b. Red
 c. Green
 d. Orange

Magnetism and Matter

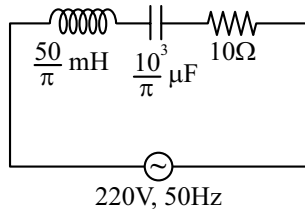
22. The net magnetic flux through any closed surface is:

- a. Negative
 b. Zero
 c. Positive
 d. Infinity

45. A wire carrying a current I along the positive x -axis has length L . It is kept in a magnetic field $\vec{B} = (2\hat{i} + 3\hat{j} - 4\hat{k})$ T. The magnitude of the magnetic force acting on the wire is:
- a. $\sqrt{3} IL$ b. $3 IL$
 c. $\sqrt{5} IL$ d. $5 IL$

Alternating Current

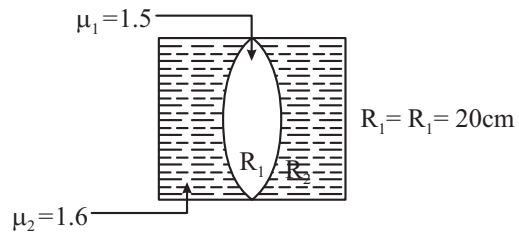
46. The net impedance of circuit (as shown in figure) will be:



- a. 25 W b. $10\sqrt{2} \Omega$
 c. 15 W d. $5\sqrt{5} \Omega$

Ray Optics and Optical Instruments

47. In the figure shown here, what is the equivalent focal length of the combination of lenses (Assume that all layers are thin)?



- a. -50 cm b. 40 cm
 c. -40 cm d. -100 cm

48. Two thin lenses are of same focal lengths (f), but one is convex and the other one is concave. When they are placed in contact with each other, the equivalent focal length of the combination will be:

- a. Infinite b. Zero
 c. $\frac{f}{4}$ d. $\frac{f}{2}$

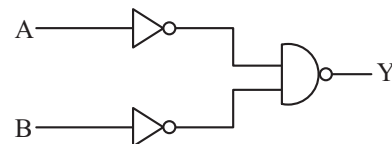
Atoms

49. The radius of inner most orbit of hydrogen atom is 5.3×10^{-11} m. What is the radius of third allowed orbit of hydrogen atom?

- a. 4.77 \AA b. 0.53 \AA
 c. 1.06 \AA d. 1.59 \AA

Semiconductor Electronics

50. For the following logic circuit, the truth table is:



- | | | | | | | | |
|--|---|---|---|----|---|---|---|
| | A | B | Y | | A | B | Y |
| | 0 | 0 | 0 | a. | 0 | 0 | 1 |
| | 0 | 1 | 0 | | 0 | 1 | 1 |
| | 1 | 0 | 0 | b. | 1 | 0 | 1 |
| | 1 | 1 | 1 | | 1 | 1 | 0 |
| | A | B | Y | | A | B | Y |
| | 0 | 0 | 0 | | 0 | 0 | 1 |
| | 0 | 1 | 1 | c. | 0 | 1 | 0 |
| | 1 | 0 | 1 | d. | 1 | 0 | 1 |
| | 1 | 1 | 1 | | 1 | 1 | 0 |

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
a	d	d	d	d	a	a	None	d	c	d	c	b	c	c	a	b
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
b	c	d	d	b	a	a	b	d	d	a	d	c	b	c	a	d
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
b	d	d	b	c	a	b	d	c	d	d	d	d	a	a	c	

Explanations

1. (a) As the factors controlling temperature and voltage supply are beyond prediction and control so the error occurred due to unpredictable fluctuations of temperature and voltage would be random errors.

2. (d) $m = \rho \pi r^2 l$

$$\rho = \frac{m}{\pi r^2 l}$$

$$\frac{\Delta \rho}{\rho} = \frac{\Delta m}{m} + \frac{2\Delta r}{r} + \frac{\Delta l}{l}$$

$$\frac{\Delta \rho}{\rho} \times 100 = \frac{0.002}{0.4} \times 100 + \frac{2 \times 0.001}{0.3} \times 100 + \frac{0.02}{5} \times 100$$

$$= \frac{0.2}{0.4} + \frac{0.2}{0.3} + \frac{2}{5}$$

$$= 0.5 + 0.67 + 0.4$$

$$= 1.57$$

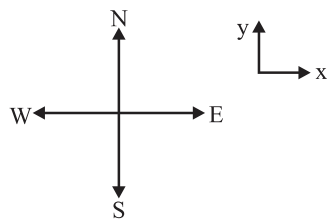
$$= 1.6\%$$

3. (d) Average speed = $\left(\frac{4v^2}{3v}\right)$

$$= \frac{4v}{3}$$

4. (d) Initial velocity = $-v\hat{j}$

$$\text{Final velocity} = v\hat{i}$$



$$\text{Change in velocity} = v\hat{i} - (-v\hat{j})$$

$$= v(\hat{i} + \hat{j})$$

Momentum gain is along $\hat{i} + \hat{j}$

\Rightarrow Force experienced is along $\hat{i} + \hat{j}$

\Rightarrow Force experienced is in North-East direction.

$$5. (d) h_{\max} = \frac{u^2 \sin^2 \theta}{2g} = \frac{280 \times 280}{2 \times 9.8} \times \frac{1}{4}$$

$$= 1000 \text{ m}$$

6. (a) Potential energy stored in the spring = $\frac{1}{2} kx^2$

$$\text{Now } \frac{1}{2} k(2)^2 = U$$

$$\& \frac{1}{2} k(8)^2 = U' \quad (\text{say})$$

$$\Rightarrow U' = \frac{64}{4} U = 16 U$$

7. (a) The angular acceleration direction is given along angular velocity or opposite to angular velocity depending upon whether angular velocity magnitude is increasing or decreasing and this direction remains along the axis of circular motion.

8. (None)

Radius of gyration of a solid surface,

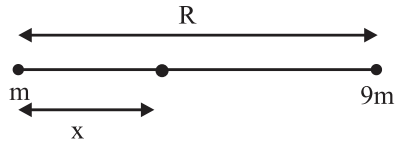
$$K_s = \sqrt{\frac{2}{5}} R$$

Radius of gyration of a hollow surface,

$$K_H = \sqrt{\frac{2}{3}} R$$

$$\Rightarrow \frac{K_s}{K_H} = \sqrt{\frac{3}{5}} = \frac{\sqrt{3}}{\sqrt{5}}$$

9. (d)



Let the gravitational field is zero at a distance x from the mass m .

$$\frac{Gm}{x^2} = \frac{G9m}{(R-x)^2}$$

$$\Rightarrow R-x = 3x \text{ or } x = \frac{R}{4}$$

Gravitational potential at $\frac{R}{4}$

$$\begin{aligned} &= -\frac{Gm}{\frac{R}{4}} - \frac{G9m}{\frac{3R}{4}} \\ &= -\frac{4Gm}{R} - \frac{12Gm}{R} \\ &= -\frac{16Gm}{R} \end{aligned}$$

$$10. (c) \text{ Stress} = \frac{F}{A} = \frac{T}{A} = \frac{W}{A}$$

11. (d) Surface energy of bubble = $2 \times \text{charge in surface area} \times \text{surface tension}$

$$\begin{aligned} &= 8\pi R^2 \times T \\ &= 8 \times 3.142 \times 4 \times 10^{-4} \times 3 \times 10^{-2} \text{ J} \\ &= 30.1 \times 10^{-5} \text{ J} \end{aligned}$$

12. (c) Factual (theory based)

$$13. (b) \eta = 1 - \frac{T_{\text{sink}}}{T_{\text{source}}} = 0.5$$

$$\begin{aligned} \frac{T_{\text{sink}}}{T_{\text{source}}} &= 0.5 \\ \Rightarrow T_{\text{sink}} &= \frac{1}{2} \times (273 + 327) \\ &= \frac{1}{2} \times 600 \\ &= 300 \text{ K} \\ &= 27^\circ\text{C} \end{aligned}$$

14. (c) $T_i = -50^\circ\text{C}$

$$\begin{aligned} &= 223 \text{ K} \\ v_{\text{rms}} &\propto \sqrt{T} \\ \text{As } v_{\text{rms}} &\text{ increased by 3 times} \\ \text{So } (v_{\text{rms}})_f &= 4(v_{\text{rms}})_{\text{initial}} \\ T_f &= 16 T_i \\ &= 16 \times 223 \\ &= 3568 \text{ K} \end{aligned}$$

$$T_f = (3568 - 273)^\circ\text{C}$$

$$= 3295^\circ\text{C}$$

15. (c) Fundamental harmonic frequency open pipe

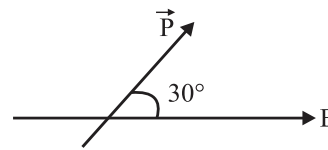
$$= \frac{v}{2L} = v_1 \quad (\text{say})$$

$$\text{Fundamental harmonic frequency of closed pipe} = \frac{v}{4L}$$

$$= v_2 \quad (\text{say})$$

$$\Rightarrow \frac{v_1}{v_2} = \frac{\frac{v}{2L}}{\frac{v}{4L}} = 2:1$$

16. (a)



$$\vec{\tau} = \vec{P} \times \vec{E}$$

$$|\vec{\tau}| = PE \sin \theta \Rightarrow 4 = q \times 2a \times E \sin 30^\circ$$

$$q = \frac{4}{(2 \times 10^{-2}) \times 2 \times 10^5 \times \left(\frac{1}{2}\right)}$$

$$= 2 \times 10^{-3} \text{ C}$$

$$= 2 \text{ mC}$$

17. (b) $\oint \vec{E} \cdot d\vec{s} = 0 \Rightarrow \phi_{\text{net}} = \phi_{\text{in}} - \phi_{\text{out}} = 0$

$$\Rightarrow \phi_{\text{in}} = \phi_{\text{out}}$$

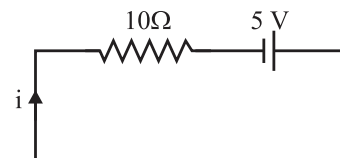
18. (b) $3\mu\text{F}$ and $3\mu\text{F}$ in parallel

$$\Rightarrow C_{\text{eqv}} = 3 + 3 = 6\mu\text{F}$$



$$\text{Now, } C'_{\text{eqv}} = \frac{3 \times 6}{9} = 2\mu\text{F}$$

19. (c) The circuit can be redrawn as an equivalent circuit given below



$$\Rightarrow i = \frac{5}{10} = 0.5 \text{ A}$$

20. (d) No current through 'G'

So potential difference across R is 2V

$$i = \frac{8}{400}$$

$$R = \left(\frac{2}{8} \times 400 \right) = 100 \Omega$$

21. (d) $R = 22 \times 10^3 \pm 5\%$

First band = Red

2nd band = Red

3rd band = Orange (Multiplier)

4th band = Gold (Tolerance)

22. (b) $\oint \vec{B} \cdot d\vec{A} = 0$ (No monopoles exist)

23. (a) Magnetic energy stored in an inductor $= \frac{1}{2} LI^2$

$$= \frac{1}{2} \times 4 \times 10^{-6} \times (2)^2$$

$$= 8 \mu\text{J}$$

24. (a) For resonance frequency

$$\omega L = \frac{1}{\omega C}$$

$$\Rightarrow \omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{10 \times 10^{-3} \times 1 \times 10^{-6}}}$$

$$= \frac{1}{\sqrt{10^{-8}}} = 10^4 \text{ rad/sec}$$

$$f = \left(\frac{\omega}{2\pi} \right) = \frac{10^4}{2\pi} = 1.59 \text{ kHz}$$

25. (b) For transformer

$$\left(\frac{i_p}{i_s} \right) = \left(\frac{V_s}{V_p} \right) = \left(\frac{N_s}{N_p} \right)$$

For bulb, $V_s = 12 \text{ V}$

$$i_s = \left(\frac{60}{12} \right) = 5 \text{ A}$$

$$\Rightarrow \frac{i_p}{5} = \left(\frac{12}{220} \right)$$

$$i_p = \frac{60}{220} = \left(\frac{3}{11} \right) = 0.27 \text{ A}$$

26. (d) Capacitive reactance $= \frac{1}{\omega C} = X_c$ (say)

on decreasing the operating frequency ω reduces

As X_c is inversely proportional to ω the value of X_c increase

$$\therefore I_c = I_d$$

$$= \frac{V_o}{X_c}$$

As X_c increases, therefore displacement current I_d decreases.

27. (d) $B = \frac{E}{C} = \frac{48}{3 \times 10^8} = 16 \times 10^{-8}$

$$= 1.6 \times 10^{-7} \text{ T}$$

28. (a) Speed of light in air is

$$C = \frac{x}{t_1}$$

Speed of light in another denser medium.

$$C_2 = \frac{10x}{t_2}$$

$$\Rightarrow \mu = \frac{C}{C_2} = \frac{x}{t_1} \times \frac{t_2}{10x}$$

$$\Rightarrow \mu = \frac{t_2}{10t_1}$$

For total internal reflection

$$\sin C = \frac{1}{\mu}$$

$$\Rightarrow \sin C = \frac{10t_1}{t_2}$$

$$C = \sin^{-1} \left(\frac{10t_1}{t_2} \right)$$

29. (d) $\Delta\theta = \frac{\lambda}{d}$

$\Delta\theta$ is proportional to λ but independent of D .

30. (c) $eV = \text{Energy of electron}$

for minimum wavelength, maximum loss of energy

$$eV = \left(\frac{hc}{\lambda} \right)$$

$$\lambda \propto \left(\frac{1}{V} \right)$$

31. (b) Incident energy = 2.20 eV

If $\phi < 2.20 \text{ eV}$ electron will emit.

$\phi > 2.20 \text{ eV}$ No electron emission

Only caesium will emit electron

32. (c) $\therefore \frac{1}{\lambda} = R \left(\frac{1}{n_2^2} - \frac{1}{n_1^2} \right)$

$$\Rightarrow \frac{1}{\lambda} = R \left(\frac{1}{2^2} \right)$$

$$\Rightarrow \lambda = \frac{4}{R}$$

$$\frac{1}{\lambda'} = R \left(\frac{1}{4^2} \right)$$

$$\Rightarrow \lambda' = \frac{16}{R}$$

$$\Rightarrow \lambda' = 4\lambda$$

$$33. (a) \frac{N}{N_0} = \frac{1}{16} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$

$$t = 4T_{1/2} = 20 \times 4 = 80 \text{ minutes}$$

34. (d) Theory based

Capacitor in parallel removes the ac ripple from the rectified output.

35. (b) Factual (theory based)

36. (d) Let height of bridge = h

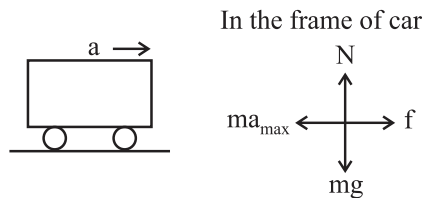
Displacement of ball, $S = -h$

$$S = ut + \frac{1}{2}at^2$$

$$-h = 4 \times 4 + \frac{1}{2}(-10)(4)^2$$

$$\Rightarrow h = 64 \text{ m}$$

37. (d)



$$N = mg$$

$$\text{and } f = ma$$

$$f \leq \mu N$$

$$\Rightarrow a \leq \mu g$$

$$\Rightarrow a \leq 1.5 \text{ ms}^{-2}$$

$$\text{or } a_{\text{max}} = 1.5 \text{ ms}^{-2}$$

$$38. (b) \frac{1}{2}m\left(\frac{u}{3}\right)^2 - \frac{1}{2}mu^2 = -F_R \times 24$$

$$0 - \frac{1}{2}mu^2 = -F_R \times d$$

$$\frac{\frac{1}{2}mu^2}{\frac{1}{2}mu^2 \times \frac{8}{9}} = \frac{d}{24}$$

$$d = 24 \times \frac{9}{8} = 27 \text{ cm}$$

39. (c) Time period of satellite

$$T = 2\pi\sqrt{\frac{R^3}{GM}}$$

$$= 2\pi\sqrt{\frac{R^3}{Gd\frac{4}{3}\pi R^3}}$$

$$\Rightarrow T = \sqrt{\frac{3\pi}{Gd}}$$

$$\Rightarrow \frac{3\pi}{Gd} = T^2$$

40. (a) From $x - t$ graph,

$$A = 1, T = 8$$

$$\Rightarrow \omega = \frac{2\pi}{T}$$

$$\Rightarrow \omega = \frac{\pi}{4}$$

$$\text{at } t = 2, x = 1$$

$$a = -\omega^2 x$$

$$\Rightarrow a = \frac{-\pi^2}{16} \times 1$$

$$\Rightarrow a = \frac{-\pi^2}{16} \text{ m/s}^2$$

41. (b) $V_p = V_q + V_{-q}$

$$= \left(\frac{Kq}{5-3} + \frac{K(-q)}{5+3}\right) \times 10^2$$

$$= \left(\frac{Kq}{2} - \frac{Kq}{8}\right) \times 10^2$$

$$= \left(\frac{3Kq}{8}\right) \times 10^2$$

42. (d) $R = R_0(1 + \alpha\Delta T)$

$$\Rightarrow 6.8 = 2[1 + \alpha \times (80 - 0)]$$

$$\Rightarrow \alpha = \frac{3.4-1}{80}$$

$$= 0.03$$

$$= 3 \times 10^{-2} \text{ } ^\circ\text{C}^{-1}$$

43. (c) $i_{\text{series}} = \frac{E}{R_{\text{series}}}$

$$\Rightarrow i_{\text{series}} = \frac{E}{10R}$$

$$i_{\text{parallel}} = \frac{E}{R_{\text{parallel}}}$$

$$= \frac{E}{R/10}$$

$$i_{\text{parallel}} = n \times i_{\text{series}}$$

$$\Rightarrow \frac{10E}{R} = \frac{nE}{10R}$$

$$\Rightarrow n = 100$$

44. (d) $\vec{B}_p = \vec{B}_{\text{upper wire}} \otimes + \vec{B}_{\text{semi-circle}} \odot + \vec{B}_{\text{lower-wire}} \otimes$

$$B_p = -\frac{\mu_0 i}{4\pi R} + \frac{\mu_0 i}{4R} - \frac{\mu_0 i}{4\pi R}$$

$$= \frac{\mu_0 i}{4R} \left(1 - \frac{2}{\pi}\right) \text{ pointing away from the page}$$

45. (d) $|\vec{F}| = |I(\vec{L} \times \vec{B})|$
 $= |I[\vec{L} \hat{i} \times (2\hat{i} + 3\hat{j} - 4\hat{k})]|$
 $= 5 IL$

46. (d) $\omega = 2\pi f \Rightarrow \omega = 100\pi$
 $Z = \sqrt{R^2 + (X_L - X_C)^2}$
 $= \sqrt{10^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$
 $= \sqrt{100 + \left(100\pi \times \frac{50}{\pi} \times 10^{-3} - \frac{1}{100\pi \times \frac{10^3}{\pi} \times 10^{-6}}\right)^2}$
 $= \sqrt{100 + (5 - 10)^2}$
 $= \sqrt{100 + 25}$
 $Z = 5\sqrt{5}\Omega$

47. (d) $\frac{1}{f_1} = (1.6 - 1) \left(\frac{1}{\infty} - \frac{1}{20}\right) = -\frac{3}{100}$
 $\frac{1}{f_2} = (1.5 - 1) \left(\frac{1}{20} - \frac{1}{-20}\right)$
 $= \frac{1}{20}$
 $\frac{1}{f_3} = \frac{1}{f_1} = -\frac{3}{100}$
 $\frac{1}{f_{\text{net}}} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$

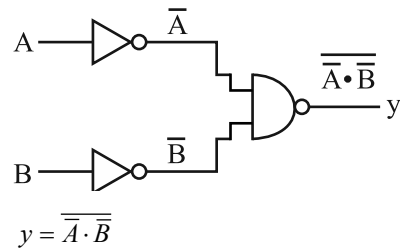
$$= -\frac{3}{50} + \frac{1}{20}$$

$$\Rightarrow f_{\text{net}} = -100 \text{ cm}$$

48. (a) $F_{\text{convex}} = f$
 $F_{\text{concave}} = -f$
 $\frac{1}{f_{\text{comb}}} = \frac{1}{F_{\text{convex}}} + \frac{1}{F_{\text{concave}}}$
 $= \frac{1}{f} - \frac{1}{f}$
 $\Rightarrow f_{\text{comb}} = \infty$

49. (a) $r_n = a_0 n_2$
 $r_1 = a_0 = 5.3 \times 10^{-11} \text{ m}$
 $r_3 = a_0(3)^2$
 $= 5.3 \times 10^{-11} \times 9$
 $= 4.77 \text{ \AA}$

50. (c)



$$= A + B$$

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Year

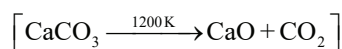
2023

NEET Solved Paper

Section-A

Some Basic Concepts of Chemistry

1. The right option for the mass of CO_2 produced by heating 20 g of 20% pure limestone is (Atomic mass of Ca = 40)



- a. 1.32 g b. 1.12 g
c. 1.76 g d. 2.64 g

Structure of Atom

2. Select the correct statements from the following:
- Atoms of all elements are composed of two fundamental particles.
 - The mass of the electron is 9.10939×10^{-31} kg.
 - All the isotopes of a given element show same chemical properties.
 - Protons and electrons are collectively known as nucleons.
 - Dalton's atomic theory, regarded the atom as an ultimate particle of matter.

Choose the correct answer from the options given below:

- a. B, C and E only b. A, B and C only
c. C, D and E only d. A and E only
3. The relation between n_m (n_m = the number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number (l), is

- a. $n_m = l + 2$ b. $l = \frac{n_m - 1}{2}$
c. $l = 2n_m + 1$ d. $n_m = 2l^2 + 1$

Classification of Elements and Periodicity in Properties

4. The element expected to form largest ion to achieve the nearest noble gas configuration is:
- a. Na b. O
c. F d. N

Chemical Bonding and Molecular Structure

5. Amongst the following, the total number of species NOT having eight electrons around central atom in its outer most shell, is: NH_3 , AlCl_3 , BeCl_2 , CCl_4 , PCl_5

- a. 1 b. 3
c. 2 d. 4

6. The correct order of energies of molecular orbitals of N_2 molecule is:

- a. $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y) < \sigma 2p_z < \sigma^* 2p_z$
b. $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < \sigma 2p_z < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$
c. $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < \sigma 2p_z < (\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$
d. $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < \sigma 2p_z < \sigma^* 2p_z < (\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y)$

7. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include:

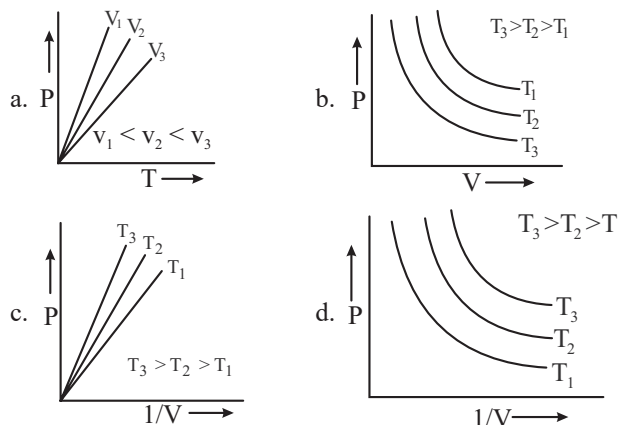
- A. dipole-dipole forces.
B. dipole - induced dipole forces,
C. hydrogen bonding.
D. covalent bonding.
E. dispersion forces.

Choose the most appropriate answer from the options given below:

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

States of Matter

8. Which amongst the following options is correct graphical representation of Boyle's Law?



Hydrogen

9. Which of the following statements are NOT correct?
- Hydrogen is used to reduce heavy metal oxides to metals.
 - Heavy water is used to study reaction mechanism.
 - Hydrogen is used to make saturated fats from oils.
 - The H-H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any element.
 - Hydrogen reduces oxides of metals that are more active than iron.

Choose the most appropriate answer from the options given below:

- a. A, B, C only b. B, C, D, E only
c. B, D only d. D, E only

The s-Block Elements

10. Which one of the following statements is correct?
- Mg plays roles in neuromuscular function and interneuronal transmission.
 - The daily requirement of Mg and Ca in the human body is estimated to be 0.2 – 0.3 g.
 - All enzymes that utilise ATP in phosphate transfer require Ca as the cofactor.
 - The bone in human body is an inert and unchanging substance.
11. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Metallic sodium dissolves in liquid ammonia giving a deep blue solution, which is paramagnetic.

Reason R: The deep blue solution is due to the formation of amide.

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

- A is false but R is true.
- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is NOT the correct explanation of A.
- A is true but R is false.

The p-Block Elements

12. Taking stability as the factor, which one of the following represents correct relationship?

- a. $\text{TlI} > \text{TlI}_3$ b. $\text{TlCl}_3 > \text{TlCl}$
c. $\text{InI}_3 > \text{InI}$ d. $\text{AlCl} > \text{AlCl}_3$

13. Match List-I with List-II

List-I

A. Coke

B. Diamond

C. Fullerene

D. Graphite

List-II

I. Carbon atoms are sp^3 hybridised.

II. Used as a dry lubricant

III. Used as a reducing agent

IV. Cage like molecules

Choose the correct answer from the options given below:

- a. A-III, B-IV, C-I, D-II b. A-II, B-IV, C-I, D-III
c. A-IV, B-I, C-II, D-III d. A-III, B-I, C-IV, D-II

Organic Chemistry-Some Basic Principles and Techniques

14. In Lassaigne's extract of an organic compound, both nitrogen and sulphur are present, which gives blood red colour with Fe^{3+} due to the formation of

- a. $[\text{Fe}(\text{SCN})]^{2+}$ b. $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot x\text{H}_2\text{O}$
c. NaSCN d. $[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$

15. The number of σ bonds, π bonds and lone pair of electrons in pyridine, respectively are

- a. 12, 2, 1 b. 11, 2, 0
c. 12, 3, 0 d. 11, 3, 1

Hydrocarbons

16. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is:

- a. 18 b. 16
c. 32 d. 30

The Solid State

17. A compound is formed by two elements A and B. The element B forms cubic close packed structure and atoms of A occupy $1/3$ of tetrahedral voids. If the formula of the compound is A_xB_y , then the value of $x + y$ is in option

- a. 2 b. 5
c. 4 d. 3

Solutions

18. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Helium is used to dilute oxygen in diving apparatus.

Reasons R: Helium has high solubility in O_2

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

- a. A is false but R is true.
 b. Both A and R are true and R is the correct explanation of A.
 c. Both A and R are true and R is NOT the correct explanation of A.
 d. A is true but R is false.

Electrochemistry

19. The conductivity of centimolar solution of KCl at 25°C is $0.0210 \text{ ohm}^{-1} \text{ cm}^{-1}$ and the resistance of the cell containing the solution at 25 °C is 60 ohm. The value of cell constant is:
- a. 3.34 cm^{-1} b. 1.34 cm^{-1}
 c. 3.28 cm^{-1} d. 1.26 cm^{-1}
20. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: In equation $\Delta_r G = -nFE_{\text{cell}}$, value of $\Delta_r G$ depends on n.

Reasons R: E_{cell} is an intensive property and $\Delta_r G$ is an extensive property.

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

- a. A is false but R is true.
 b. Both A and R are true and R is the correct explanation of A.
 c. Both A and R are true but R is NOT the correct explanation of A.
 d. A is true but R is false

Chemical Kinetics

21. For a certain reaction, the rate = $k[A]^2[B]$. When the initial concentration of A is tripled keeping concentration of B constant, the initial rate would
- a. increase by a factor of three.
 b. decrease by a factor of nine.
 c. increase by a factor of six.
 d. increase by a factor of nine
22. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: A reaction can have zero activation energy.

Reason R: The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to threshold value, is called activation energy.

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

- a. A is false but R is true.
 b. Both A and R are true and R is the correct explanation of A.
 c. Both A and R are true and R is NOT the correct explanation of A.
 d. A is true but R is false.

Surface Chemistry

23. Which one is an example of heterogenous catalysis?
- a. Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.
 b. Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen.
 c. Hydrolysis of sugar catalysed by H^+ ions.
 d. Decomposition of ozone in presence of nitrogen monoxide.

The p-Block Elements (Group 15 to 18)

24. Amongst the given options, which of the following molecules/ion acts as a Lewis acid?
- a. OH^- b. NH_3
 c. H_2O d. BF_3

The d-and f-Block Elements

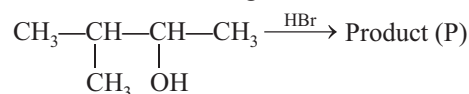
25. The stability of Cu^{2+} is more than Cu^+ salts in aqueous solutions due to:
- a. second ionisation enthalpy
 b. first ionisation enthalpy
 c. enthalpy of atomisation
 d. hydration energy

Coordination Compounds

26. Homoleptic complex from the following complexes is:
- a. Triamminetriaquachromium (III) chloride
 b. Potassium trioxalatoaluminate (III)
 c. Diamminechloridonitrito – N- platinum(II)
 d. Pentaamminecarbonatocobalt (III) chloride

Haloalkanes and Haloarenes

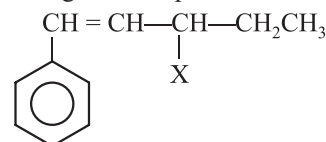
27. Consider the following reaction and identify the product (P).



3-Methylbutan -2-ol

- a. $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3-\text{C}-\text{CH}_2\text{Br} \\ | \\ \text{CH}_3 \end{array}$ b. $\begin{array}{c} \text{Br} \\ | \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$
 c. $\text{CH}_3\text{CH}=\text{CH}-\text{CH}_3$ d. $\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}-\text{CH}_3 \\ | \quad | \\ \text{CH}_3 \quad \text{Br} \end{array}$

28. The given compound

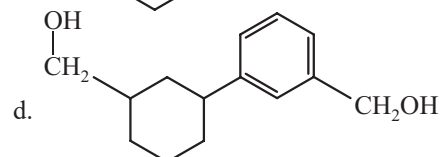
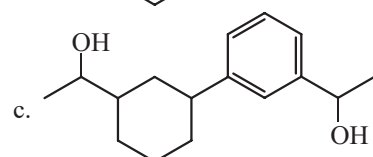
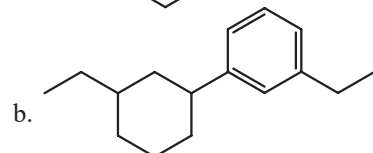
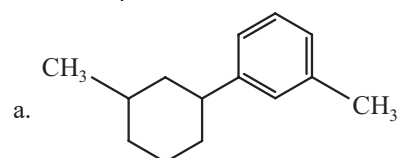
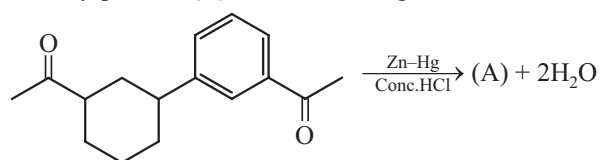


is an example of _____.

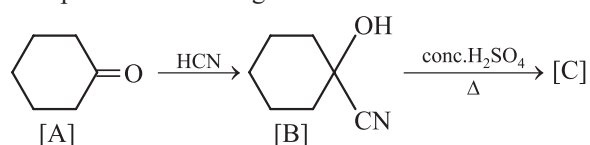
- a. vinylic halide b. benzylic halide
 c. aryl halide d. allylic halide

Aldehydes, Ketones and Carboxylic Acids

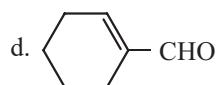
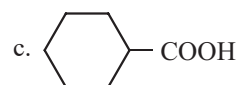
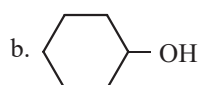
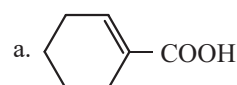
29. Identify product (A) in the following reaction:



30. Complete the following reaction :

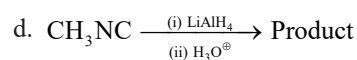
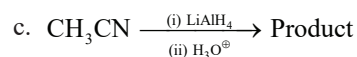
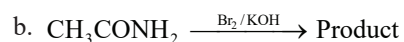
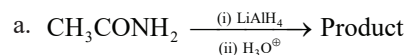


[C] is _____

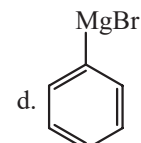
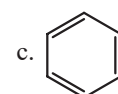
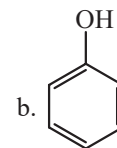
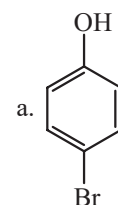
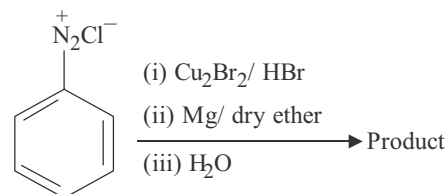


Amines

31. Which of the following reactions will NOT give primary amine as the product?



32. Identify the product in the following reaction:



Biomolecules

33. Given below are two statements:

Statement I: A unit formed by the attachment of a base to 1' position of sugar is known as nucleoside

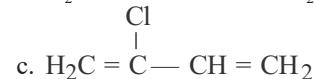
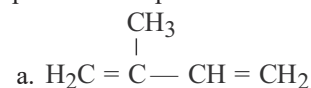
Statement II: When nucleoside is linked to phosphorous acid at 5'-position of sugar moiety, we get nucleotide.

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

- Statement I is false but Statement II is true.
- Both Statement I and Statement II are true.
- Both Statement I and Statement II are false.
- Statement I is true but Statement II is false.

Polymers

34. Which amongst the following molecules on polymerization produces neoprene?



Chemistry in Everyday Life

35. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?

- Veronal
- Chlordiazepoxide
- Meprobamate
- Valium

Section-B

Thermodynamics

36. Which amongst the following options is the correct relation between change in enthalpy and change in internal Energy?
- a. $\Delta H + \Delta U = \Delta nR$ b. $\Delta H = \Delta U - \Delta n_g RT$
 c. $\Delta H = \Delta U + \Delta n_g RT$ d. $\Delta H - \Delta U = -\Delta nRT$

Equilibrium

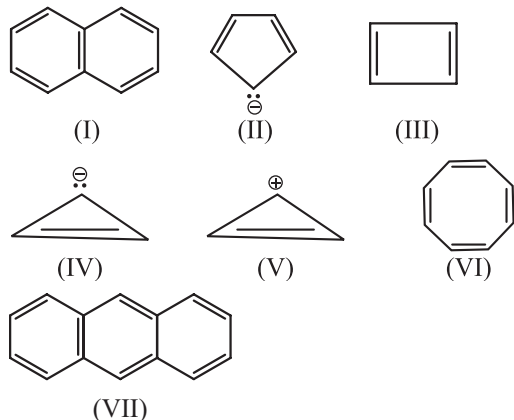
37. The equilibrium concentrations of the species in the reaction $A + B \rightleftharpoons C + D$ are 2, 3, 10 and 6 mol L⁻¹ respectively at 300 K. ΔG^0 for the reaction is (R = 2 cal/mol K)
- a. -13.73 cal b. 1372.60 cal
 c. -137.26 cal d. -1381.80 cal

Redox Reactions

38. On balancing the given redox reaction,
 $aCr_2O_7^{2-} + bSO_3^{2-}(aq) + cH^+(aq) \rightarrow$
 $2aCr^{3+}(aq) + bSO_4^{2-}(aq) + c/2 H_2O(l)$
 the coefficients a, b and c are found to be, respectively:
- a. 8, 1, 3 b. 1, 3, 8
 c. 3, 8, 1 d. 1, 8, 3

Hydrocarbons

39. Consider the following compounds/species :



The number of compounds/species which obey Huckel's rule is _____.

- a. 5 b. 4
 c. 6 d. 2

Environmental Chemistry

40. Given below are two statements:

Statement I: The nutrient deficient water bodies lead to eutrophication.

Statement II: Eutrophication leads to decrease in the level of oxygen in water bodies.

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

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

The Solid State

41. What fraction of one edge centred octahedral void lies in one unit cell of fcc?
- a. $\frac{1}{12}$ b. $\frac{1}{2}$
 c. $\frac{1}{3}$ d. $\frac{1}{4}$

Surface Chemistry

42. Pumic stone is an example of:
- a. foam b. sol
 c. gel d. solid sol

General Principles and Processes of Isolation of Elements

43. The reaction that does not take place in blast furnace between 900 K to 1500 K in temperature range during extraction of iron is:
- a. $CaO + SiO_2 \rightarrow CaSiO_3$
 b. $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$
 c. $FeO + CO \rightarrow Fe + CO_2$
 d. $C + CO_2 \rightarrow 2CO$

The p-Block Elements (Group 15 to 18)

44. Match List-I with List-II:

	List-I (Oxoacids of Sulphur)		List-II (Bonds of Sulphur)
A.	Peroxodisulphuric acid	I.	Two S-OH, Four S=O, One S-O-S
B.	Sulphuric acid	II.	Two S-OH, One S=O
C.	Pyrosulphuric acid	III.	Two S-OH, Four S=O, One S-O-O-S
D.	Sulphurous acid	IV.	Two S-OH, Two S=O

Choose the correct answer from the options given below :

- a. A-III, B-IV, C-II, D-I b. A-I, B-III, C-II, D-IV
 c. A-III, B-IV, C-I, D-II d. A-I, B-III, C-IV, D-II

The d- and f-Block Elements

45. Which of the following statements are INCORRECT?
- A. All the transition metals except scandium form MO oxides which are ionic.
- B. The highest oxidation number corresponding to the group number in transition metal oxides is attained in Sc_2O_3 to Mn_2O_7 .
- C. Basic character increases from V_2O_3 to V_2O_4 to V_2O_5 .
- D. V_2O_4 dissolves in acids to give VO_4^{3-} salts.
- E. CrO is basic but Cr_2O_3 is amphoteric.

Choose the correct answer from the options given below:

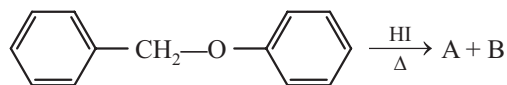
- a. B and C only b. A and E only
c. B and D only d. C and D only

Coordination Compounds

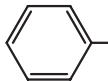
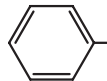
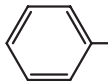
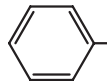
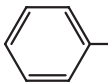
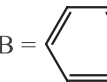
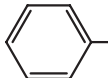
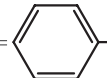
46. Which complex compound is most stable?
- a. $[\text{Co}(\text{NH}_3)_6]_2(\text{SO}_4)_3$
b. $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Br}](\text{NO}_3)_2$
c. $[\text{Co}(\text{NH}_3)_3(\text{NO}_3)_3]$
d. $[\text{CoCl}_2(\text{en})_2]\text{NO}_3$

Alcohols, Phenols and Ethers

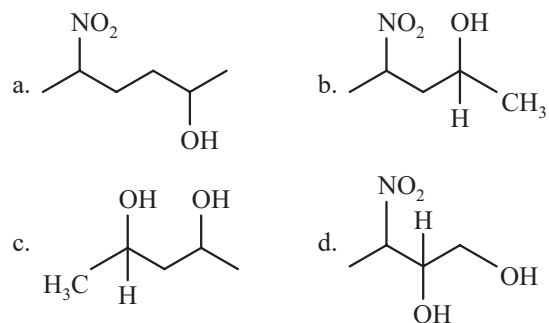
47. Consider the following reaction



Identify products A and B

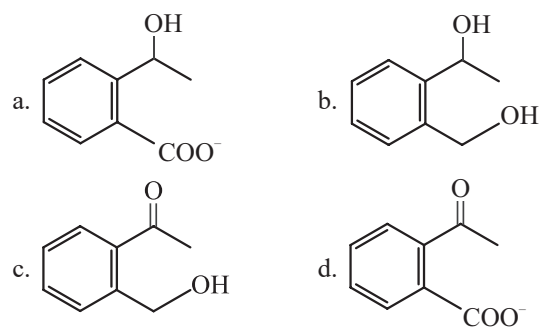
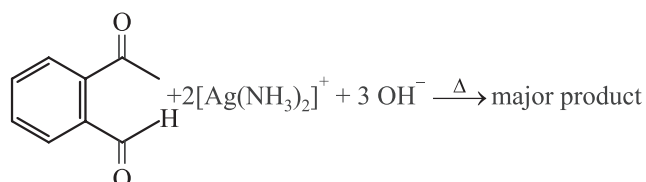
- a. A =  and B = 
b. A =  and B = 
c. A =  and B = 
d. A =  and B = 

48. Which amongst the following will be most readily dehydrated under acidic conditions ?

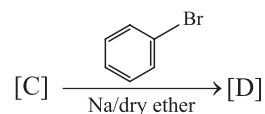
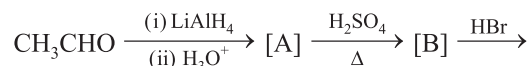


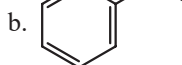
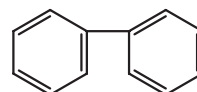
Aldehydes, Ketones and Carboxylic Acids

49. Identify the major product obtained in the following reaction:



50. Identify the final product [D] obtained in the following sequence of reactions,



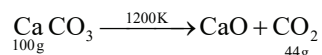
- a. $\text{HC} \equiv \text{C}^-\text{Na}^+$ b. 
- c.  d. C_4H_{10}

Answer Key

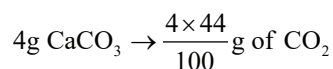
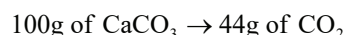
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
c	a	b	d	b	b	d	c	d	b	d	a	d	a	d	c	b
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
d	d	b	d	c	a	d	d	b	b	d	b	a	d	c	d	c
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
a	c	d	b	b	a	d	d	b	c	d	d	d	c	d	b	

Explanations

1. (c) $20 \text{ g of } 20\% \text{ CaCO}_3 = 20 \times \frac{20}{100} = 4 \text{ g CaCO}_3$



According to the reaction,



$$= 1.76 \text{ g of CO}_2$$

2. (a) An Atom has three fundamental particles—electron, proton and neutron.

The mass of the electron is $9.10939 \times 10^{-31} \text{ kg}$.

Neutrons and protons, both are collectively known as nucleons.

All the isotopes of a given element show same chemical properties.

Dalton's atomic theory, regarded atom as an ultimate particle of matter.

3. (b) $n_m = 2l + 1$

As there are $(2l + 1)$ number of permissible values of magnetic quantum number.

$$\text{Hence, } l = \frac{n_m - 1}{2}$$

4. (d) Among isoelectronic monoatomic species, size is inversely proportional to atomic number.

Hence among isoelectronic species Na^+ , O^{2-} , N^{3-} , F^- (having nearest noble gas configuration);

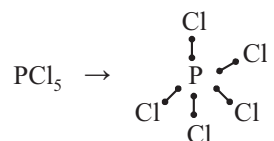
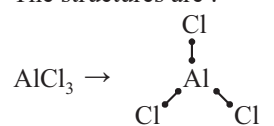
Order of size is $\text{Na}^+ < \text{F}^- < \text{O}^{2-} < \text{N}^{3-}$

N^{3-} has least atomic number hence largest size.

5. (b) AlCl_3 , BeCl_2 and PCl_5 does not obey octet rule.

AlCl_3 and BeCl_2 both are electron-deficient species having six electrons in valence shell of central atom whereas PCl_5 has ten electrons in valence shell of phosphorous.

The structures are :



6. (b) $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < \sigma 2p_z < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$

is the correct order of energy of MO for homo nuclear diatomic species N_2 .

7. (d) Covalent bonding is NOT an intermolecular force while rest all are considered as intermolecular forces.

8. (c) $PV = nRT$

$$P = nRT.(1/V)$$

Plot of P vs $(1/V)$ would be straight line passing through origin having slope = nRT .

At high temperatures, P vs $(1/V)$ would have greater slope.

9. (d) A, B and C are correct statements.

The H-H bond dissociation enthalpy is highest for a single bond between two atoms of any element.

Hydrogen does not reduce oxides of metals that are more active than iron.

10. (b) Ca plays important role in Neuromuscular function and interneuronal transmission

The daily requirement of Mg and Ca in the human body is estimated to be 200 –300 mg.

All enzymes that utilise ATP in phosphate transfer require Mg as the cofactor.

The bone in human body is NOT an inert and unchanging substance.

11. (d) The para-magnetism of solution of alkali metals in liquid ammonia and its deep blue color is due to ammoniated electrons. Which absorb energy in visible region of light

12. (a) Tl^{+3} is less stable than Tl^{+1} (inert pair effect)

Going down the group 13, stability of lower oxidation state increases.

In case of B, Al, Ga and In, higher O.S. +3 remains more stable than lower O.S. +1.

But, in last stable element, thallium (Tl), lower O.S. +1 become more stable than higher O.S. +3.

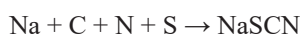
13. (d) Coke- reducing agent

Diamond- sp^3 carbons

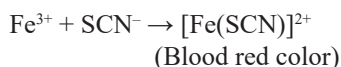
Fullerenes- cage like structure

Graphite- used as lubricant

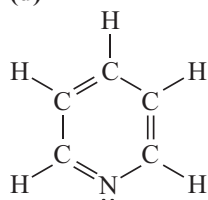
14. (a) In case, nitrogen and sulphur both are present in an organic compound, sodium thiocyanate is formed.



Which further reacts as:

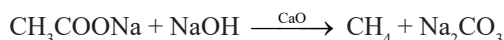


15. (d) The structure of pyridine is:



Hence, it has 11 sigma, 3 π bonds and one lone pair.

16. (c) Sodium ethanoate is CH_3COONa and given process is soda-lime decarboxylation.



Methane is obtained having molar mass 16. Two moles would be 32 g.

17. (b) Since, atom B forms CCP structure. Therefore, there will be 4-B atoms.

Now, atom A occupies 1/3 of tetrahedral voids.

Hence, number of A atoms = $1/3 \times 8 = 8/3$

The correct formula of the compound = $A_{8/3}B_4$



$$x + y = 2 + 3 = 5$$

18. (d) Helium is used as a diluent for oxygen in modern diving apparatus because of its very low solubility in blood.

19. (d) Conductivity = Conductance \times Cell constant

$$\text{Conductivity} = (1/\text{resistance})$$

$$\text{Cell constant} = \text{Conductivity} \times \text{Resistance}$$

$$\text{Cell constant} = 0.0210 \times 60 = 1.26 \text{ Cm}^{-1}$$

20. (b) Free energy is extensive property, and E°_{cell} is an intensive property $\Delta_r G$ is depends on the 'n' which is number of electron transferred in the reaction $\Delta_r G = -nFE^\circ$

21. (d) Let the new rate be, R' .

$$A' = [3A], B' = [B]$$

$$R' = K[A']^2 [B']$$

$$= K[3A]^2 [B]$$

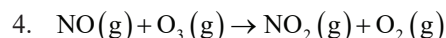
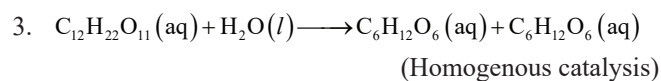
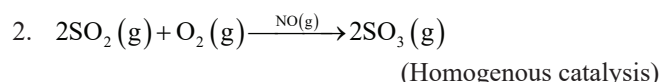
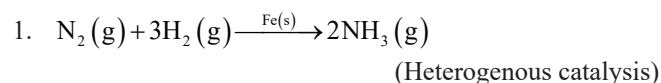
$$= 9K[A]^2 [B]$$

$$= 9 \times R$$

Hence, rate would become nine times.

22. (c) A reaction can have zero activation energy, for example, $\cdot CH_3 + \cdot CH_3 \rightarrow CH_3-CH_3$ has zero activation energy.

23. (a) When the reactants and the catalyst are in different phases, then the catalysis is known as heterogenous catalysis.



24. (d) BF_3 behaves as Lewis acid due to incomplete octet in valence shell of Boron. Hence it can accept a lone pair of electrons.

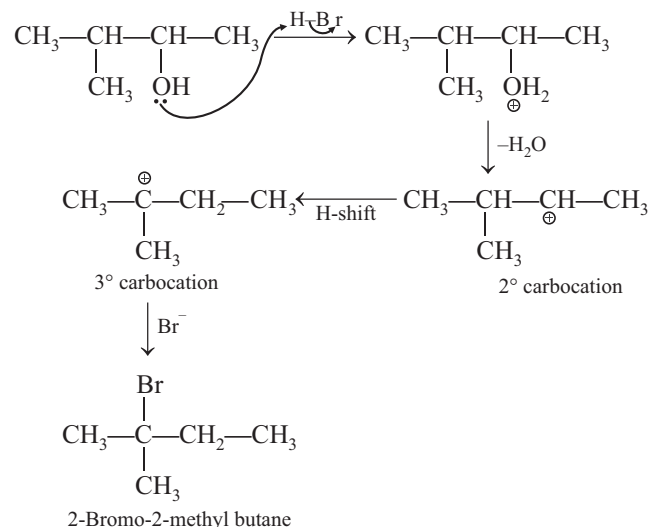
25. (d) The greater stability of $Cu^{2+}(aq)$ rather than $Cu^+(aq)$ is due to the much more negative $\Delta_{\text{hyd}}H$ of $Cu^{2+}(aq)$ than Cu^+ , which more than compensates for the second ionisation enthalpy of Cu.

26. (b) Homoleptic complexes have all ligands identical.

Potassium trioxalatoaluminate (III) is $K_3[Al(C_2O_4)_3]$ which has only oxalate ion as ligand.

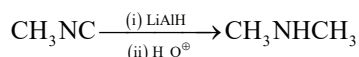
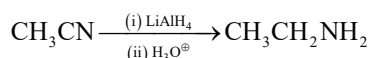
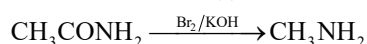
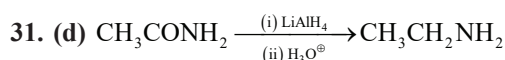
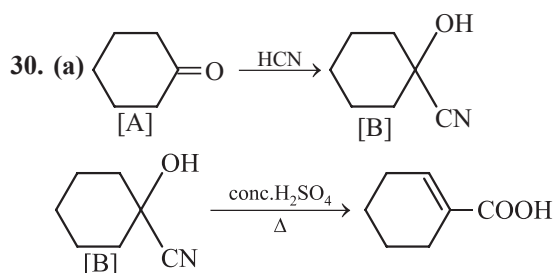
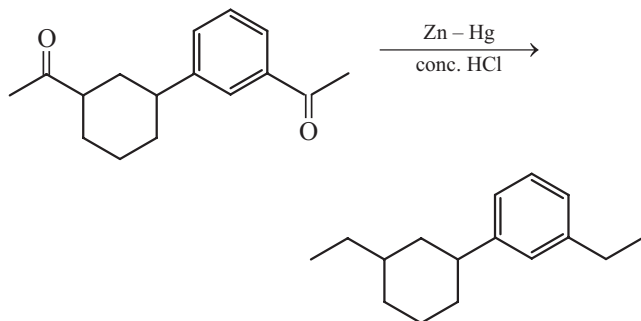
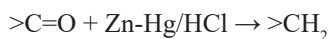
All others have more than one type of ligands.

27. (b) Initially, after protonation followed by loss of water, secondary carbocation is formed, further Hydride shift leads to 3° carbocation.



28. (d) Allylic halide have halogen bonded to sp^3 carbon which is adjacent to $>C=C<$

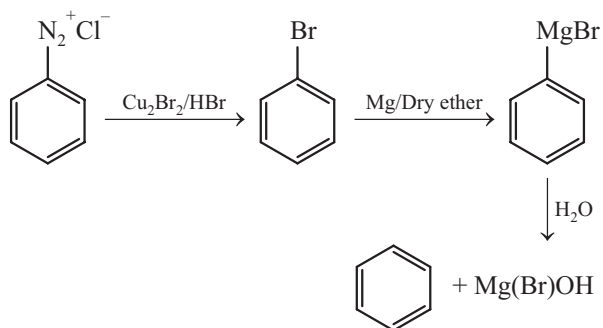
29. (b) Ketones are reduced into hydrocarbons using Zn-Hg/HCl (Clemmenson reduction).



Methyl isocyanide gives a secondary amine, CH_3NHCH_3 , upon reduction.

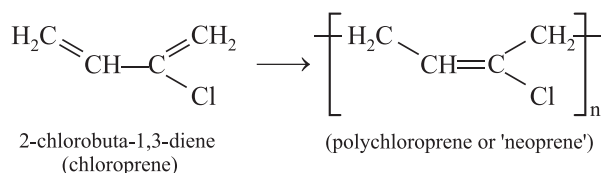
32. (c) Bromobenzene is formed in first step (Sandmeyer reaction), which further gives phenyl magnesium bromide.

Phenyl magnesium bromide further gives benzene with water.



33. (d) When nucleoside is linked to **phosphoric acid** at 5'-position of sugar moiety, we get nucleotide.

34. (c) Chloroprene is the monomer of neoprene.



35. (a) Veronal is a barbiturate drug and it constitute an important class of tranquilizers.

36. (c) $\Delta H = \Delta U + \Delta n_g RT$

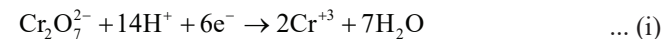
37. (d) $K_{eq} = \frac{[C][D]}{[A][B]}$

$$K_{eq} = (10 \times 6)/(2 \times 3) = 10$$

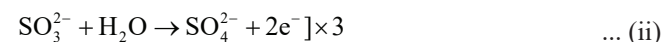
$$\Delta G^0 = -2.303 RT \log K_{eq} = -2.303(2)(300)(\log 10)$$

$$= -1381.8 \text{ cal} \quad (\because R = 2 \text{ cal/mol K})$$

38. (b) Reduction half reaction.

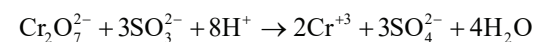


Oxidation half reaction



Oxygen is balanced by adding water and hydrogen is balanced by adding H^+ and the charge is balanced by electrons.

Add(eq. (i)) + (3 \times eq. (ii))

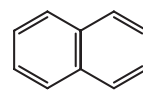


$$a = 1 \quad b = 3 \quad c = 8$$

39. (b) Acc. to Huckel rule, A compound/molecule is said to be aromatic if it have cyclic conjugate and $[4n + 2]\pi$ electron system

\Rightarrow Molecule must be sp^2 hybridised

\Rightarrow Molecule must be planar.



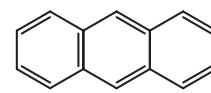
10 π e's



6 π e's



2 π e's



14 π e's

All these are aromatic species acc. to Huckel rule.

40. (a) Eutrophication occurs when the water body becomes **overly enriched** with nutrients.

Eutrophication leads to decrease in the level of dissolved oxygen (DO) in water bodies.

41. (d) One edge of an cube is common to four unit cells.

Hence One edge centre OV contribute $\frac{1}{4}$ to one unit cell.

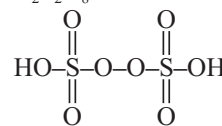
42. (d) Pumice stone is an example of solid sol. In this type of colloid, the dispersion medium is solid and the dispersion phase is gas.

43. (b) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$

The above reaction takes place at 500 – 800 K in blast furnace.

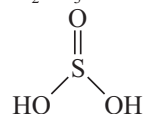
44. (c)

$H_2S_2O_8$, peroxodisulphuric acid



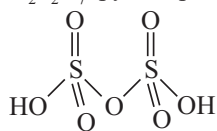
(Two S-OH, Four S=O, One S-O-O-S)

H_2SO_3 , sulphurous acid



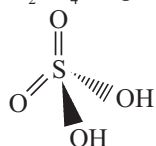
(Two S-OH, One S=O bond)

$\text{H}_2\text{S}_2\text{O}_7$, pyrosulphuric acid



(Two S-OH, Four S = O,
One S-O-S bond)

H_2SO_4 , sulphuric acid



(Two S-OH, Two S=O)

45. (d) The highest oxidation number corresponding to the group number in transition metal oxides is attained in Sc_2O_3 to Mn_2O_7 .

CrO is basic but Cr_2O_3 is amphoteric.

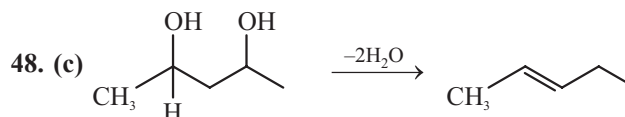
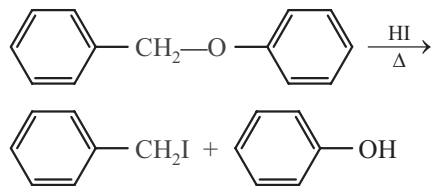
Note:

All the transition metals except scandium form MO oxides which are ionic (Only for 3d series, this statement is true)

Hence, (A), (C) and (D) are incorrect. But not given in the options.

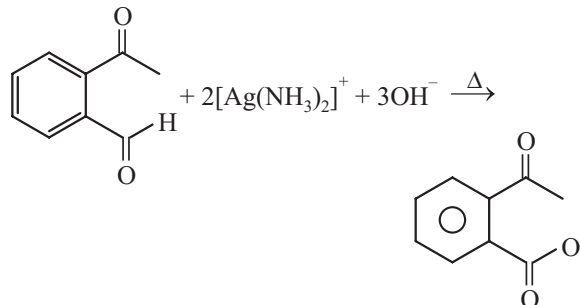
46. (d) **Ethylene diamine**, en is bidentate, chelating ligand. Chelating ligands increase stability due to higher entropy factor.

47. (d) Reaction follows $\text{S}_{\text{N}}1$ pathway involving Benzylic carbocation.

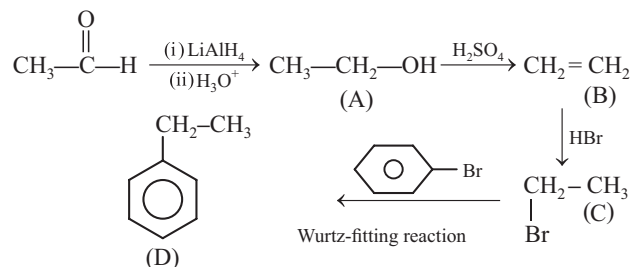


Formation of Conjugated diene in option 3 make the given reactant most reactive towards dehydration in acidic conditions.

49. (d) Tollen's reagent oxidises aldehydes into carboxylate ion whereas ketone is not oxidised by tollen's reagent.



50. (b)



LiAlH_4 used for reduction of carbonyl group into alcohol and H_2SO_4 used for dehydration of alcohol.