

NEET (UG) 2020

Question Paper with Answers and Solutions

Questions	180	Maximum marks	720
Language	English	Marking	+4 correct, -1 wrong, 0 blank
Biology	Questions 1 to 90		
Chemistry	Questions 91 to 135		
Physics	Questions 136 to 180		

INSTRUCTIONS

1. This booklet carries all 180 questions of the official NEET (UG) 2020 paper, set by the National Testing Agency (NTA), in NTA's order and numbering.
2. Each question is followed by its answer and a worked solution written by BrainIt. Cover the solution with a sheet of paper to attempt a question first.
3. Each question has four options, numbered (1) to (4). Where NTA accepted more than one option, the answer lists all of them.
4. For exam practice, attempt the whole paper in one sitting, timed as in the exam, then mark it: +4 for a correct answer, -1 for a wrong one, 0 for a question left blank.
5. This paper is also online, with every solution, at brainit.pro/neet/question-papers/neet-2020/

Name			
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BIOLOGY

1. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is 6.6×10^9 bp, then the length of the DNA is approximately

- (1) 2.5 meters (2) 2.2 meters
(3) 2.7 meters (4) 2.0 meters

Answer (2)

Sol. The length of the DNA can be calculated using the formula $L = n \times d$, where n is the number of base pairs and d is the distance between two consecutive base pairs. Substituting the values, $L = 6.6 \times 10^9 \times 0.34 \times 10^{-9} \text{ m} = 2.244 \text{ m} \approx 2.2 \text{ m}$. Chapter: Molecular Basis of Inheritance.

2. Bilaterally symmetrical and acoelomate animals are exemplified by

- (1) Platyhelminthes (2) Aschelminthes
(3) Annelida (4) Ctenophora

Answer (1)

Sol. Platyhelminthes are bilaterally symmetrical and acoelomate, lacking a body cavity. Chapter: Animal Kingdom.

3. Match the following columns and select the correct option.

List I	List II
P) Gregarious, polyphagous pest	I) <i>Asterias</i>
Q) Adult with radial symmetry and larva with bilateral symmetry	II) Scorpion
R) Book lungs	III) <i>Ctenoplane</i>
S) Bioluminescence	IV) <i>Locusta</i>

- (1) P-IV, Q-I, R-II, S-III (2) P-III, Q-II, R-I, S-IV
(3) P-II, Q-I, R-III, S-IV (4) P-I, Q-III, R-II, S-IV

Answer (1)

Sol. *Locusta* is a gregarious polyphagous pest; adult *Asterias* has radial symmetry while its larva is bilateral; scorpions have book lungs; and *Ctenoplane* is bioluminescent. Thus P-IV, Q-I, R-II, S-III. Chapter: Animal Kingdom.

4. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?

- (1) Peroxisomes (2) Golgi bodies
(3) Polysomes (4) Endoplasmic reticulum

Answer (2)

Sol. Golgi bodies are the primary site for the formation of glycoproteins and glycolipids in eukaryotic cells. Chapter: Cell: The Unit of Life.

5. The QRS complex in a standard ECG represents

- (1) Depolarisation of auricles
(2) Depolarisation of ventricles
(3) Repolarisation of ventricles
(4) Repolarisation of auricles

Answer (2)

Sol. The QRS complex in a standard electrocardiogram (ECG) represents the depolarisation of the ventricles, which initiates ventricular contraction. Chapter: Body Fluids and Circulation.

6. Match the following columns and select the correct option.

List I	List II
P) Floating ribs	I) Located between second and seventh ribs
Q) Acromion	II) Head of the humerus
R) Scapula	III) Clavicle
S) Glenoid cavity	IV) Do not connect with the sternum

- (1) P-I, Q-III, R-II, S-IV (2) P-III, Q-II, R-IV, S-I
(3) P-IV, Q-III, R-I, S-II (4) P-II, Q-IV, R-I, S-III

Answer (3)

Sol. Floating ribs do not connect with the sternum; the acromion articulates with the clavicle; the scapula lies between the second and seventh ribs; and the glenoid cavity receives the humeral head. Thus P-IV, Q-III, R-I, S-II. Chapter: Locomotion and Movement.

7. Experimental verification of the chromosomal theory of inheritance was done by

- (1) Sutton (2) Boveri (3) Morgan (4) Mendel

Answer (3)

Sol. Thomas Hunt Morgan provided experimental verification of the chromosomal theory of inheritance through his work with *Drosophila melanogaster*. Chapter: Principles of Inheritance and Variation.

8. Identify the incorrect statement.

- (1) Sapwood is involved in conduction of water and minerals from root to leaf
- (2) Sapwood is the innermost secondary xylem and is lighter in colour
- (3) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour
- (4) Heart wood does not conduct water but gives mechanical support

Answer (2)

Sol. Sapwood is not the innermost secondary xylem; it is the outer, living part of the secondary xylem that is involved in water and mineral conduction. Heartwood is the inner, non-living part that provides mechanical support and is darker in color due to deposits of tannins, resins, and oils. Chapter: Anatomy of Flowering Plants.

9. Match the following columns and select the correct option.

List I	List II
P) Pituitary gland	I) Grave's disease
Q) Thyroid gland	II) Diabetes mellitus
R) Adrenal gland	III) Diabetes insipidus
S) Pancreas	IV) Addison's disease

- (1) P-III, Q-II, R-I, S-IV (2) P-III, Q-I, R-IV, S-II
- (3) P-II, Q-I, R-IV, S-III (4) P-IV, Q-III, R-I, S-II

Answer (2)

Sol. Pituitary/antidiuretic hormone (ADH) dysfunction causes diabetes insipidus, thyroid hyperactivity causes Graves' disease, adrenal hypofunction causes Addison's disease, and pancreatic insulin dysfunction causes diabetes mellitus. Thus P-III, Q-I, R-IV, S-II. Chapter: Chemical Coordination and Integration.

10. Match the organism with its use in biotechnology and select the correct option.

List I	List II
P) <i>Bacillus thuringiensis</i>	I) Cloning vector
Q) <i>Thermus aquaticus</i>	II) Construction of first rDNA molecule
R) <i>Agrobacterium tumefaciens</i>	III) DNA polymerase
S) <i>Salmonella typhimurium</i>	IV) Cry proteins

- (1) P-IV, Q-III, R-I, S-II (2) P-III, Q-II, R-IV, S-I
- (3) P-III, Q-IV, R-I, S-II (4) P-II, Q-IV, R-III, S-I

Answer (1)

Sol. *Bacillus thuringiensis* supplies Cry proteins; *Thermus aquaticus* supplies thermostable DNA polymerase; *Agrobacterium tumefaciens* is a plant cloning vector; and *Salmonella typhimurium* was used in the first recombinant-DNA construction. Thus P-IV, Q-III, R-I, S-II. Chapter: Biotechnology: Principles and Processes.

11. Identify the substances having glycosidic bond and peptide bond, respectively in their structure

- (1) Glycerol, trypsin (2) Cellulose, lecithin
- (3) Inulin, insulin (4) Chitin, cholesterol

Answer (3)

Sol. Inulin contains a glycosidic bond, linking its fructose units. Insulin contains peptide bonds, linking its amino acid residues. Chapter: Biomolecules.

12. Name the enzyme that facilitates opening of DNA helix during transcription.

- (1) DNA helicase (2) DNA polymerase
- (3) RNA polymerase (4) DNA ligase

Answer (3)

Sol. During transcription, DNA-dependent RNA polymerase binds the promoter and locally opens the DNA helix to expose the template strand. DNA helicase is primarily associated with replication, so the keyed answer is RNA polymerase. Chapter: Molecular Basis of Inheritance.

13. If the head of cockroach is removed, it may live for few days because

- (1) the cockroach does not have nervous system.
- (2) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
- (3) the head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.
- (4) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.

Answer (2)

Sol. The cockroach can survive for a few days without its head because the major part of its nervous system, including segmental ganglia, is situated along the ventral part of its body. This allows basic functions to continue even without the head. Chapter: Structural Organisation in Animals.

14. Select the correct events that occur during inspiration.

Statement I: Contraction of diaphragm

Statement II: Contraction of external inter-costal muscles

Statement III: Pulmonary volume decreases

Statement IV: Intra pulmonary pressure increases

(1) (III) and (IV) (2) (I), (II) and (IV)

(3) only (IV) (4) (I) and (II)

Answer (4)

Sol. Inspiration requires contraction of the diaphragm and external intercostal muscles. Thoracic and pulmonary volume increase while intrapulmonary pressure falls, so only statements (I) and (II) are correct. Chapter: Breathing and Exchange of Gases.

15. By which method was a new breed 'Hisardale' of sheep formed by using Bikaneri ewes and Marino rams?

(1) Mutational breeding (2) Cross breeding

(3) Inbreeding (4) Out crossing

Answer (2)

Sol. Hisardale was produced by crossing Bikaneri ewes with Merino rams, so it is a cross-bred sheep variety. Chapter: Strategies for Enhancement in Food Production.

16. Which one of the following is the most abundant protein in the animals?

(1) Collagen (2) Lectin

(3) Insulin (4) Haemoglobin

Answer (1)

Sol. Collagen is the most abundant protein in animals, forming the structural framework of bones, skin, and connective tissues. Chapter: Biomolecules.

17. How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?

(1) 2 (2) 14 (3) 8 (4) 4

Answer (2)

Sol. Mendel selected 14 true breeding pea plant varieties as pairs, each differing in one character with contrasting traits. Chapter: Principles of Inheritance and Variation.

18. The body of the ovule is fused within the funicle at

(1) Micropyle (2) Nucellus

(3) Chalaza (4) Hilum

Answer (4)

Sol. The body of the ovule is fused to the funicle at the hilum. Chapter: Sexual Reproduction in Flowering

Plants.

19. Which of the following is correct about viroids?

(1) They have free RNA without protein coat

(2) They have DNA with protein coat

(3) They have free DNA without protein coat

(4) They have RNA with protein coat

Answer (1)

Sol. Viroids are infectious agents composed of short strands of naked RNA without a protein coat. Chapter: Biological Classification.

20. The number of substrate level phosphorylations in one turn of citric acid cycle is

(1) One (2) Two (3) Three (4) Zero

Answer (1)

Sol. In one turn of the citric acid cycle, there is one substrate-level phosphorylation event, which occurs during the conversion of succinyl-CoA to succinate. Chapter: Respiration in Plants.

21. The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants is/are

(1) Nitrate alone (2) Ammonia and oxygen

(3) Ammonia and hydrogen (4) Ammonia alone

Answer (3)

Sol. Nitrogenase catalyzes the reduction of atmospheric nitrogen to ammonia and hydrogen gas. Chapter: Mineral Nutrition.

22. Match the following diseases with the causative organism and select the correct option.

List I	List II
P) Typhoid	I) <i>Wuchereria</i>
Q) Pneumonia	II) <i>Plasmodium</i>
R) Filariasis	III) <i>Salmonella</i>
S) Malaria	IV) <i>Haemophilus</i>

(1) P-III, Q-IV, R-I, S-II (2) P-II, Q-I, R-III, S-IV

(3) P-IV, Q-I, R-II, S-III (4) P-I, Q-III, R-II, S-IV

Answer (1)

Sol. Typhoid-*Salmonella*, pneumonia-*Haemophilus*, filariasis-*Wuchereria* and malaria-*Plasmodium* give P-III, Q-IV, R-I, S-II. Chapter: Human Health and Disease.

23. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask

- (1) CH_3 , H_2 , NH_4 and water vapor at 800°C
- (2) CH_4 , H_2 , NH_3 and water vapor at 600°C
- (3) CH_3 , H_2 , NH_3 and water vapor at 600°C
- (4) CH_4 , H_2 , NH_3 and water vapor at 800°C

Answer (4)

Sol. S.L. Miller's experiment used a mixture of CH_4 , H_2 , NH_3 , and water vapor at a high temperature (800°C) to simulate early Earth conditions and produce amino acids. Chapter: Evolution.

24. Which of the following statements is correct?

- (1) Adenine pairs with thymine through one H-bond
- (2) Adenine pairs with thymine through three H-bonds
- (3) Adenine does not pair with thymine
- (4) Adenine pairs with thymine through two H-bonds

Answer (4)

Sol. In double-stranded DNA, adenine pairs with thymine through two hydrogen bonds, while guanine pairs with cytosine through three. Complementary base pairing explains the hydrogen-bond count asked here.

25. Match the following with respect to meiosis and select the correct option.

List I	List II
P) Zygotene	I) Terminalization
Q) Pachytene	II) Chiasmata
R) Diplotene	III) Crossing over
S) Diakinesis	IV) Synapsis

- (1) P-IV, Q-III, R-II, S-I (2) P-I, Q-II, R-IV, S-III
- (3) P-II, Q-IV, R-III, S-I (4) P-III, Q-IV, R-I, S-II

Answer (1)

Sol. Synapsis occurs in zygotene, crossing over in pachytene, chiasmata become visible in diplotene, and terminalization occurs in diakinesis. Thus P-IV, Q-III, R-II, S-I. Chapter: Cell Cycle and Cell Division.

26. Which enzyme is correctly matched with its function?

- (1) Polymerases - Break the DNA into fragments
- (2) Nucleases - Separate the two strands of DNA
- (3) Exonucleases - Make cuts at specific positions within DNA
- (4) Ligases - Join the two DNA molecules

Answer (4)

Sol. DNA ligase joins DNA fragments by sealing breaks in the sugar-phosphate backbone. It forms phosphodiester bonds between adjacent 3'-hydroxyl and 5'-phosphate ends.

27. Select the option including all sexually transmitted diseases.

- (1) Gonorrhoea, Malaria, Genital herpes
- (2) AIDS, Malaria, Filariasis
- (3) Cancer, AIDS, Syphilis
- (4) Gonorrhoea, Syphilis, Genital herpes

Answer (4)

Sol. Gonorrhoea, Syphilis, and Genital herpes are all sexually transmitted diseases (STDs). Malaria, Filariasis, and Cancer are not STDs. Chapter: Reproductive Health.

28. Embryological support for evolution was disapproved by

- (1) Alfred Wallace (2) Charles Darwin
- (3) Oparin (4) Karl Ernst von Baer

Answer (4)

Sol. Karl Ernst von Baer criticized the idea that embryos of different species pass through the same stages of development, which was a key argument for embryological support of evolution. Chapter: Evolution.

29. The roots that originate from the base of the stem are

- (1) Primary roots (2) Prop roots
- (3) Lateral roots (4) Fibrous roots

Answer (4)

Sol. Roots arising in clusters from the base of the stem replace the short-lived primary root and form a fibrous root system, as in grasses. Chapter: Morphology of Flowering Plants.

30. In gel electrophoresis, separated DNA fragments can be visualized with the help of

- (1) Ethidium bromide in UV radiation
- (2) Acetocarmine in UV radiation
- (3) Ethidium bromide in infrared radiation
- (4) Acetocarmine in bright blue light

Answer (1)

Sol. Separated DNA fragments in gel electrophoresis are visualized using ethidium bromide, which intercalates with DNA and fluoresces under ultraviolet (UV) radiation. Chapter: Biotechnology: Principles and Processes.

31. Which of the following hormone levels will cause release of ovum (ovulation) from the graffian follicle?

- (1) High concentration of Progesterone
- (2) Low concentration of LH
- (3) Low concentration of FSH
- (4) High concentration of Estrogen

Answer (4)

Sol. High concentrations of estrogen trigger the release of luteinizing hormone (LH), which in turn causes ovulation. Chapter: Human Reproduction.

32. Goblet cells of alimentary canal are modified from

- (1) Columnar epithelial cells
- (2) Chondrocytes
- (3) Compound epithelial cells
- (4) Squamous epithelial cells

Answer (1)

Sol. Goblet cells are modified columnar epithelial cells that secrete mucus to lubricate and protect the lining of the alimentary canal. Chapter: Digestion and Absorption.

33. Snow-blindness in Antarctic region is due to

- (1) Inflammation of cornea due to high dose of UV-B radiation
- (2) High reflection of light from snow
- (3) Damage to retina caused by infra-red rays
- (4) Freezing of fluids in the eye by low temperature

Answer (1)

Sol. Snow-blindness in the Antarctic region is caused by inflammation of the cornea due to high doses of UV-B radiation, which can be reflected off snow surfaces. Chapter: Environmental Issues.

34. Match the following concerning essential elements and their functions in plants.

List I	List II
P) Iron	I) Photolysis of water
Q) Zinc	II) Pollen germination
R) Boron	III) Required for chlorophyll biosynthesis
S) Manganese	IV) IAA biosynthesis

- (1) P-IV, Q-III, R-II, S-I (2) P-III, Q-IV, R-II, S-I
- (3) P-IV, Q-I, R-II, S-III (4) P-II, Q-I, R-IV, S-III

Answer (2)

Sol. Iron is required for chlorophyll biosynthesis, zinc for indole-3-acetic acid (IAA) biosynthesis, boron for pollen germination, and manganese for water photolysis. Thus P-III, Q-IV, R-II, S-I. Chapter: Mineral Nutrition.

35. Bt cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (Bt) is resistant to

- (1) Fungal diseases (2) Plant nematodes
- (3) Insect predators (4) Insect pests

Answer (4)

Sol. Bt cotton, developed by introducing the toxin gene from *Bacillus thuringiensis*, is resistant to insect pests. This gene produces a protein that is toxic to certain insects, making Bt cotton effective against insect pests. Chapter: Biotechnology and its Applications.

36. Ray florets have

- (1) Superior ovary (2) Hypogynous ovary
- (3) Half inferior ovary (4) Inferior ovary

Answer (4)

Sol. Ray florets of Asteraceae are epigynous; the other floral whorls arise above the ovary, so the ovary is inferior. Chapter: Morphology of Flowering Plants.

37. Montreal protocol was signed in 1987 for control of

- (1) Emission of ozone depleting substances
- (2) Release of Green House gases
- (3) Disposal of e-wastes
- (4) Transport of Genetically modified organisms from one country to another

Answer (1)

Sol. The Montreal Protocol, signed in 1987, aims to control the emission of ozone-depleting substances. Chapter: Environmental Issues.

38. Identify the wrong statement with regard to restriction enzymes.

- (1) They cut the strand of DNA at palindromic sites.
- (2) They are useful in genetic engineering.
- (3) Sticky ends can be joined by using DNA ligases.
- (4) Each restriction enzyme functions by inspecting the length of a DNA sequence.

Answer (3)

Sol. Each restriction enzyme recognizes and cuts DNA at specific palindromic sequences, not by inspecting the length of a DNA sequence. Chapter: Biotechnology: Principles and Processes.

39. The infectious stage of *Plasmodium* that enters the human body is

- (1) Sporozoites (2) Female gametocytes
(3) Male gametocytes (4) Trophozoites

Answer (1)

Sol. The infectious stage of *Plasmodium* that enters the human body is the sporozoite stage. Sporozoites are transmitted through the saliva of an infected female *Anopheles* mosquito. Chapter: Human Health and Disease.

40. Meiotic division of the secondary oocyte is completed

- (1) At the time of copulation
(2) After zygote formation
(3) At the time of fusion of a sperm with an ovum
(4) Prior to ovulation

Answer (3)

Sol. Meiotic division of the secondary oocyte is completed at the time of fusion of a sperm with an ovum, forming the second polar body. Chapter: Human Reproduction.

41. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of

- (1) 1 molecule of 3-C compound
(2) 1 molecule of 6-C compound
(3) 1 molecule of 4-C compound and 1 molecule of 2-C compound
(4) 2 molecules of 3-C compound

Answer (1)

Sol. During photorespiration, the oxygenation activity of RuBisCo leads to the formation of one molecule of 3-phosphoglycerate (3-C) and one molecule of phosphoglycolate (2-C). Chapter: Photosynthesis in Higher Plants.

42. Which of the following statements are true for the phylum-Chordata?

Statement I: In Urochordata notochord extends from head to tail and it is present throughout their life.

Statement II: In Vertebrata notochord is present during the embryonic period only.

Statement III: Central nervous system is dorsal and hollow.

Statement IV: Chordata is divided into 3 subphyla : Hemichordata, Tunicata and Cephalochordata.

- (1) (III) and (I) (2) (I) and (II)
(3) (II) and (III) (4) (IV) and (III)

Answer (3)

Sol. Statement I is false because urochordates retain the notochord only in the larval tail. Statement IV is false because Hemichordata is not a chordate subphylum. Statements (II) and (III) are true. Chapter: Animal Kingdom.

43. Match the following columns and select the correct option.

List I	List II
P) <i>Clostridium butylicum</i>	I) Cyclosporin A
Q) <i>Trichoderma polysporum</i>	II) Butyric acid
R) <i>Monascus purpureus</i>	III) Citric acid
S) <i>Aspergillus niger</i>	IV) Blood-cholesterol-lowering agent

- (1) P-II, Q-I, R-IV, S-III (2) P-I, Q-II, R-IV, S-III
(3) P-IV, Q-III, R-II, S-I (4) P-III, Q-IV, R-II, S-I

Answer (1)

Sol. *Clostridium butylicum* produces butyric acid; *Trichoderma polysporum* produces cyclosporin A; *Monascus purpureus* produces statins that lower blood cholesterol; and *Aspergillus niger* produces citric acid. Thus P-II, Q-I, R-IV, S-III. Chapter: Microbes in Human Welfare.

44. Which of the following pairs is of unicellular algae?

- (1) *Gelidium* and *Gracilaria*
(2) *Anabaena* and *Volvox*
(3) *Chlorella* and *Spirulina*
(4) *Laminaria* and *Sargassum*

Answer (3)

Sol. *Chlorella* and *Spirulina* are both unicellular algae. *Chlorella* is a green alga, and *Spirulina* is a cyanobacterium, both of which are unicellular. Chapter: Plant Kingdom.

45. In light reaction, plastoquinone facilitates the transfer of electrons from

- (1) Cytb6f complex to PS-I
(2) PS-I to NADP⁺
(3) PS-I to ATP synthase
(4) PS-II to Cytb6f complex

Answer (4)

Sol. Plastoquinone facilitates the transfer of electrons from PS-II to the cytochrome *b₆f* complex during the light reactions of photosynthesis. Chapter: Photosynthesis in Higher Plants.

46. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus?

- (1) Uremia and Renal Calculi
- (2) Ketonuria and Glycosuria
- (3) Renal calculi and Hyperglycaemia
- (4) Uremia and Ketonuria

Answer (2)

Sol. Glycosuria and ketonuria together indicate diabetes mellitus: excess blood glucose spills into urine and increased fat use produces urinary ketone bodies. Chapter: Excretory Products and their Elimination.

47. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their

- (1) Growth response
- (2) Defence action
- (3) Effect on reproduction
- (4) Nutritive value

Answer (2)

Sol. Secondary metabolites like nicotine, strychnine, and caffeine are produced by plants for defence against herbivores and pathogens. Chapter: Organisms and Populations.

48. Which of the following would help in prevention of diuresis?

- (1) Reabsorption of Na^+ and water from renal tubules due to aldosterone
- (2) Atrial natriuretic factor causes vasoconstriction
- (3) Decrease in secretion of renin by JG cells
- (4) More water reabsorption due to undersecretion of ADH

Answer (1)

Sol. Aldosterone promotes the reabsorption of Na^+ and water from the renal tubules, reducing urine volume and preventing diuresis. Chapter: Excretory Products and their Elimination.

49. Select the correct match

- (1) Phenylketonuria - Autosomal dominant trait
- (2) Sickle cell anaemia - Autosomal recessive trait, chromosome-11
- (3) Thalassemia - X linked
- (4) Haemophilia - Y linked

Answer (2)

Sol. - Haemophilia is X-linked recessive. - Phenylketonuria is autosomal recessive. - Sickle cell anaemia is an autosomal recessive trait linked to chromosome 11. - Thalassemia is autosomal recessive, not X-linked. Chapter: Principles of Inheritance and Variation.

50. Which of the following is not an attribute of a population?

- (1) Natality
- (2) Mortality
- (3) Species interaction
- (4) Sex ratio

Answer (3)

Sol. Species interaction is a characteristic of communities, not populations. Chapter: Organisms and Populations.

51. Which of the following statements about inclusion bodies in incorrect?

- (1) These are involved in ingestion of food particles
- (2) They lie free in the cytoplasm
- (3) These represent reserve material in cytoplasm
- (4) They are not bound by any membrane

Answer (1)

Sol. Inclusion bodies lie free in the cytoplasm, store reserve material and lack a bounding membrane. They are not involved in ingestion of food particles, making that statement incorrect. Chapter: Cell: The Unit of Life.

52. The transverse section of a plant shows following anatomical features :

Statement I: Large number of scattered vascular bundles surrounded by bundle sheath

Statement II: Large conspicuous parenchymatous ground tissue

Statement III: Vascular bundles conjoint and closed

Statement IV: Phloem parenchyma absent

Identify the category of plant and its part :

- (1) Monocotyledonous root
- (2) Dicotyledonous stem
- (3) Dicotyledonous root
- (4) Monocotyledonous stem

Answer (4)

Sol. The described features-scattered vascular bundles, large parenchymatous ground tissue, conjoint and closed vascular bundles, and absence of phloem parenchyma-are characteristic of a monocotyledonous stem. Chapter: Anatomy of Flowering Plants.

53. In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?

- (1) Gross primary productivity is always more than net primary productivity
- (2) Gross primary productivity and Net primary productivity are one and same
- (3) There is no relationship between Gross primary productivity and Net primary productivity
- (4) Gross primary productivity is always less than net primary productivity

Answer (1)

Sol. Gross primary productivity (GPP) is the total amount of energy fixed by photosynthesis, while net primary productivity (NPP) is GPP minus the energy used by plants for respiration. Therefore, GPP is always more than NPP. Chapter: Ecosystem.

54. In water hyacinth and water lily, pollination takes place by :

- (1) Water currents only (2) Wind and water
- (3) Insects and water (4) Insects or wind

Answer (4)

Sol. The flowers of water hyacinth and water lily emerge above the water surface and are pollinated by insects or wind, not by water currents. Chapter: Sexual Reproduction in Flowering Plants.

55. Which of the following is put into Anaerobic sludge digester for further sewage treatment?

- (1) Floating debris
- (2) Effluents of primary treatment
- (3) Activated sludge
- (4) Primary sludge

Answer (3)

Sol. Activated sludge, which contains microorganisms, is added to the anaerobic sludge digester to further break down organic matter in the sewage. Chapter: Microbes in Human Welfare.

56. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is

- (1) Root pressure (2) Imbibition
- (3) Plasmolysis (4) Transpiration

Answer (1)

Sol. The liquid-water loss is guttation. Root pressure supplies the positive force that pushes xylem sap out through hydathodes at night or early morning, so root pressure is the facilitating process. Chapter: Transport in Plants.

57. Cuboidal epithelium with brush border of microvilli is found in

- (1) Ducts of salivary glands
- (2) Proximal convoluted tubule of nephron
- (3) Eustachian tube
- (4) Lining of intestine

Answer (2)

Sol. Cuboidal epithelium with a brush border of microvilli is found in the proximal convoluted tubule of the nephron, where it increases the surface area for reabsorption. Chapter: Structural Organisation in Animals.

58. Select the correct statement.

- (1) Glucagon is associated with hypoglycemia.
- (2) Insulin acts on pancreatic cells and adipocytes.
- (3) Insulin is associated with hyperglycemia.
- (4) Glucocorticoids stimulate gluconeogenesis.

Answer (4)

Sol. Glucocorticoids, such as cortisol, stimulate gluconeogenesis, the process of glucose synthesis from non-carbohydrate sources. Chapter: Chemical Coordination and Integration.

59. Which of the following is not an inhibitory substance governing seed dormancy?

- (1) Absciscic acid (2) Phenolic acid
- (3) Para-ascorbic acid (4) Gibberellic acid

Answer (4)

Sol. Gibberellic acid is a plant hormone that promotes seed germination, not dormancy. Absciscic acid, phenolic acid, and para-ascorbic acid are known to inhibit seed germination and maintain dormancy. Chapter: Plant Growth and Development.

60. According to Robert May, the global species diversity is about

- (1) 20 million (2) 50 million
- (3) 7 million (4) 1.5 million

Answer (3)

Sol. Robert May estimated the global species diversity to be around 7 million species. Chapter: Biodiversity and Conservation.

61. Match the trophic levels with their correct species examples in a grassland ecosystem.

List I	List II
P) Fourth trophic level	I) Crow
Q) Second trophic level	II) Vulture
R) First trophic level	III) Rabbit
S) Third trophic level	IV) Grass

- (1) P-III, Q-II, R-I, S-IV (2) P-IV, Q-III, R-II, S-I
 (3) P-I, Q-II, R-III, S-IV (4) P-II, Q-III, R-IV, S-I

Answer (4)

Sol. Grass is the first trophic level, rabbit the second, crow the third and vulture the fourth. Thus P-II, Q-III, R-IV, S-I. Chapter: Ecosystem.

62. The first phase of translation is

- (1) Recognition of DNA molecule
 (2) Aminoacylation of tRNA
 (3) Recognition of an anti-codon
 (4) Binding of mRNA to ribosome

Answer (2)

Sol. Before peptide synthesis begins, each amino acid is activated and attached to its cognate transfer RNA (tRNA) by aminoacyl-tRNA synthetase. This aminoacylation or charging of tRNA is the first phase of translation. Chapter: Molecular Basis of Inheritance.

63. Strobili or cones are found in

- (1) *Pteris* (2) *Marchantia*
 (3) *Equisetum* (4) *Salvinia*

Answer (3)

Sol. Strobili or cones are found in *Equisetum*, a genus of plants commonly known as horsetails. Chapter: Plant Kingdom.

64. Match the following columns and select the correct option.

List I	List II
P) 6-15 pairs of gill slits	I) <i>Trygon</i>
Q) Heterocercal caudal fin	II) Cyclostomes
R) Air bladder	III) Chondrichthyes
S) Poison sting	IV) Osteichthyes

- (1) P-III, Q-IV, R-I, S-II (2) P-IV, Q-II, R-III, S-I
 (3) P-I, Q-IV, R-III, S-II (4) P-II, Q-III, R-IV, S-I

Answer (4)

Sol. Cyclostomes have 6-15 pairs of gill slits; Chondrichthyes have a heterocercal caudal fin; Osteichthyes generally have an air bladder; and

Trygon bears a poison sting. Thus P-II, Q-III, R-IV, S-I. Chapter: Animal Kingdom.

65. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G₀). This process occurs at the end of

- (1) G₁ phase (2) S phase
 (3) G₂ phase (4) M phase

Answer (1)

Sol. Cells can exit the cell cycle and enter the quiescent stage (G₀) at the end of the G₁ phase. Chapter: Cell Cycle and Cell Division.

66. Identify the correct statement with reference to human digestive system.

- (1) Serosa is the innermost layer of the alimentary canal
 (2) Ileum is a highly coiled part
 (3) Vermiform appendix arises from duodenum
 (4) Ileum opens into small intestine

Answer (2)

Sol. The ileum is a highly coiled part of the small intestine, responsible for the absorption of nutrients. Chapter: Digestion and Absorption.

67. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?

- (1) GIFT and ZIFT (2) ICSI and ZIFT
 (3) GIFT and ICSI (4) ZIFT and IUT

Answer (4)

Sol. Zygote intra fallopian transfer (ZIFT) transfers an early embryo into the fallopian tube, while intra uterine transfer (IUT) transfers an embryo with more than eight blastomeres into the uterus. Gamete intra fallopian transfer (GIFT) transfers gametes and intra cytoplasmic sperm injection (ICSI) is fertilisation outside the body, so the embryo-transfer pair is ZIFT and IUT. Chapter: Reproductive Health.

68. The plant parts which consist of two generations - one within the other

Statement I: Pollen grains inside the anther

Statement II: Germinated pollen grain with two male gametes

Statement III: Seed inside the fruit

Statement IV: Embryo sac inside the ovule

- (1) (I), (II) and (III) (2) (III) and (IV)
 (3) (I) and (IV) (4) (I) only

Answer (3)

Sol. Pollen grains inside the anther and embryo sac inside the ovule both consist of two generations, one within the other. Pollen grains contain microspores (haploid) and the embryo sac contains the female gametophyte (haploid) within the ovule (diploid). Chapter: Sexual Reproduction in Flowering Plants.

69. Dissolution of the synaptonemal complex occurs during

- (1) Zygotene (2) Diplotene
(3) Leptotene (4) Pachytene

Answer (2)

Sol. The synaptonemal complex dissolves during diplotene, leading to the separation of homologous chromosomes while they remain connected at chiasmata. Chapter: Cell Cycle and Cell Division.

70. Match the following columns and select the correct option.

List I	List II
P) Organ of Corti	I) Connects middle ear and pharynx
Q) Cochlea	II) Coiled part of the labyrinth
R) Eustachian tube	III) Attached to the oval window
S) Stapes	IV) Located on the basilar membrane

- (1) P-III, Q-I, R-IV, S-II (2) P-IV, Q-II, R-I, S-III
(3) P-I, Q-II, R-IV, S-III (4) P-II, Q-III, R-I, S-IV

Answer (2)

Sol. The organ of Corti lies on the basilar membrane; the cochlea is the coiled labyrinth; the Eustachian tube joins the middle ear to the pharynx; and the stapes contacts the oval window. Thus P-IV, Q-II, R-I, S-III. Chapter: Neural Control and Coordination.

71. The ovary is half inferior in :

- (1) Mustard (2) Sunflower
(3) Plum (4) Brinjal

Answer (3)

Sol. Plum has a perigynous flower and a half-inferior ovary. Mustard, sunflower and brinjal have superior or inferior ovaries rather than the half-inferior condition asked here. Chapter: Morphology of Flowering Plants.

72. Identify the basic amino acid from the following.

- (1) Glutamic Acid (2) Lysine
(3) Valine (4) Tyrosine

Answer (2)

Sol. Lysine is a basic amino acid due to its positively charged amino group on the side chain. Chapter: Biomolecules.

73. Match the following columns and select the correct option.

List I	List II
P) Eosinophils	I) Immune response
Q) Basophils	II) Phagocytosis
R) Neutrophils	III) Release histaminase and destructive enzymes
S) Lymphocytes	IV) Release granules containing histamine

- (1) P-IV, Q-I, R-II, S-III (2) P-I, Q-II, R-IV, S-III
(3) P-II, Q-I, R-III, S-IV (4) P-III, Q-IV, R-II, S-I

Answer (4)

Sol. Eosinophils release histaminase and destructive enzymes; basophils release histamine-containing granules; neutrophils are phagocytic; and lymphocytes mediate immune responses. Thus P-III, Q-IV, R-II, S-I. Chapter: Body Fluids and Circulation.

74. Match the following and select the correct option.

List I	List II
P) Inhibitor of catalytic activity	I) Ricin
Q) Possess peptide bonds	II) Malonate
R) Cell-wall material in fungi	III) Chitin
S) Secondary metabolite	IV) Collagen

- (1) P-III, Q-I, R-IV, S-II (2) P-III, Q-IV, R-I, S-II
(3) P-II, Q-III, R-I, S-IV (4) P-II, Q-IV, R-III, S-I

Answer (4)

Sol. Malonate inhibits catalytic activity competitively; collagen contains peptide bonds; fungal walls contain chitin; and ricin is a secondary metabolite. Thus P-II, Q-IV, R-III, S-I. Chapter: Biomolecules.

75. Identify the correct statement with regard to G1 phase (Gap 1) of interphase.

- (1) Reorganisation of all cell components takes place.
(2) Cell is metabolically active, grows but does not replicate its DNA.
(3) Nuclear Division takes place.
(4) DNA synthesis or replication takes place.

Answer (2)

Sol. During the G1 phase, the cell is metabolically active and grows, but DNA replication does not occur. Chapter: Cell Cycle and Cell Division.

76. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

- (1) Gibberellin (2) Ethylene
(3) Absciscic acid (4) Cytokinin

Answer (1)

Sol. Gibberellins, when sprayed on sugarcane, promote stem elongation and increase the yield. Chapter: Plant Growth and Development.

77. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.

- (1) A person will have only two of the three alleles.
(2) When I^A and I^B are present together, they express same type of sugar.
(3) Allele 'i' does not produce any sugar.
(4) The gene (I) has three alleles.

Answer (2)

Sol. The gene 'I' has three alleles: I^A , I^B , and i. A person will have only two of these alleles. When I^A and I^B are present together, they express different types of sugars, not the same type. The allele i does not produce any sugar. Chapter: Principles of Inheritance and Variation.

78. Identify the wrong statement with reference to immunity.

- (1) When ready-made antibodies are directly given, it is called "Passive immunity".
(2) Active immunity is quick and gives full response.
(3) Foetus receives some antibodies from mother, it is an example for passive immunity.
(4) When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called "Active immunity".

Answer (2)

Sol. Active immunity involves the production of antibodies by the host's immune system, which takes time to develop a full response, not immediately. Chapter: Human Health and Disease.

79. The enzyme enterokinase helps in conversion of

- (1) trypsinogen into trypsin
(2) caseinogen into casein
(3) pepsinogen into pepsin
(4) protein into polypeptides

Answer (1)

Sol. Enterokinase converts trypsinogen into trypsin, an active protease in the small intestine. Chapter: Digestion and Absorption.

80. The specific palindromic sequence which is recognized by EcoRI is

- (1) 5 - GGAACC - 3 3 - CCTTGG - 5
(2) 5 - CTTAAG - 3 3 - GAATTC - 5
(3) 5 - GGATCC - 3 3 - CCTAGG - 5
(4) 5 - GAATTC - 3 3 - CTTAAG - 5

Answer (4)

Sol. Restriction enzyme from *Escherichia coli* RY 13 (EcoRI) recognizes the palindromic sequence 5' - GAATTC - 3' and its complementary strand 3' - CTTAAG - 5'. Chapter: Biotechnology: Principles and Processes.

81. Match the following columns and select the correct option.

List I	List II
P) Bt cotton	I) Gene therapy
Q) Adenosine deaminase deficiency	II) Cellular defence
R) RNAi	III) Detection of HIV infection
S) PCR	IV) <i>Bacillus thuringiensis</i>

- (1) P-III, Q-II, R-I, S-IV (2) P-II, Q-III, R-IV, S-I
(3) P-I, Q-II, R-III, S-IV (4) P-IV, Q-I, R-II, S-III

Answer (4)

Sol. Bt cotton is linked to *Bacillus thuringiensis*, ADA deficiency to gene therapy, RNA interference to cellular defence and polymerase chain reaction (PCR) to human immunodeficiency virus (HIV) detection. Thus P-IV, Q-I, R-II, S-III. Chapter: Biotechnology and its Applications.

82. Floridean starch has structure similar to

- (1) Amylopectin and glycogen
(2) Mannitol and algin
(3) Laminarin and cellulose
(4) Starch and cellulose

Answer (1)

Sol. Floridean starch has a structure similar to amylopectin and glycogen, both of which are branched polysaccharides. Chapter: Plant Kingdom.

83. Which of the following statements is not correct?

- (1) The proinsulin has an extra peptide called C-peptide.
- (2) The functional insulin has A and B chains linked together by hydrogen bonds.
- (3) Genetically engineered insulin is produced in *E.Coli*.
- (4) In man insulin is synthesised as a proinsulin

Answer (2)

Sol. The functional insulin has A and B chains linked together by disulfide bonds, not hydrogen bonds. Chapter: Biotechnology and its Applications.

84. Flippers of Penguins and Dolphins are examples of

- (1) Convergent evolution
- (2) Industrial melanism
- (3) Natural selection
- (4) Adaptive radiation

Answer (1)

Sol. Flippers of penguins and dolphins are examples of convergent evolution, where unrelated organisms develop similar traits due to similar environmental pressures. Chapter: Evolution.

85. Which of the following refer to correct example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?

Statement I: Darwin's Finches of Galapagos islands.
Statement II: Herbicide resistant weeds.
Statement III: Drug resistant eukaryotes.
Statement IV: Man-created breeds of domesticated animals like dogs.

- (1) (I) and (III)
- (2) (II), (III) and (IV)
- (3) only (IV)
- (4) only (I)

Answer (2)

Sol. Herbicide-resistant weeds, drug-resistant eukaryotes and human-created dog breeds reflect anthropogenic selection. Darwin's finches arose through natural environmental selection, so (II), (III) and (IV) are correct. Chapter: Evolution.

86. Identify the wrong statement with reference to transport of oxygen.

- (1) Partial pressure of CO_2 can interfere with O_2 binding with haemoglobin
- (2) Higher H^+ conc. in alveoli favours the formation of oxyhaemoglobin
- (3) Low pCO_2 in alveoli favours the formation of oxyhaemoglobin
- (4) Binding of oxygen with haemoglobin is mainly related to partial pressure of O_2

Answer (2)

Sol. Higher H^+ concentration in the alveoli does not favour the formation of oxyhaemoglobin; instead, it promotes the release of O_2 from haemoglobin. Chapter: Breathing and Exchange of Gases.

87. The process of growth is maximum during

- (1) Lag phase
- (2) Senescence
- (3) Dormancy
- (4) Log phase

Answer (4)

Sol. The process of growth is maximum during the log phase, when cells divide rapidly and the population increases exponentially. Chapter: Plant Growth and Development.

88. Which of the following regions of the globe exhibits highest species diversity?

- (1) Madagascar
- (2) Himalayas
- (3) Amazon forests
- (4) Western Ghats of India

Answer (3)

Sol. The Amazon forests are known for the highest species diversity due to their vast area, varied habitats, and tropical climate. Chapter: Biodiversity and Conservation.

89. The sequence that controls the copy number of the linked DNA in the vector, is termed

- (1) Ori site
- (2) Palindromic sequence
- (3) Recognition site
- (4) Selectable marker

Answer (1)

Sol. The origin of replication (Ori site) controls the copy number of the linked DNA in a vector. This site is essential for the initiation of DNA replication and determines how many copies of the plasmid are made within the host cell. Chapter: Biotechnology: Principles and Processes.

90. Match the following columns and select the correct option.

List I	List II
P) Placenta	I) Androgens
Q) Zona pellucida	II) Human chorionic gonadotropin (hCG)
R) Bulbo-urethral glands	III) Layer of the ovum
S) Leydig cells	IV) Lubrication of the penis

- (1) P-I, Q-IV, R-II, S-III
- (2) P-III, Q-II, R-IV, S-I
- (3) P-II, Q-III, R-IV, S-I
- (4) P-IV, Q-III, R-I, S-II

Answer (3)

Sol. The placenta secretes hCG; zona pellucida is the ovum's glycoprotein layer; bulbo-urethral secretions lubricate the penis; and Leydig cells secrete androgens. Thus P-II, Q-III, R-IV, S-I. Chapter: Human Reproduction.

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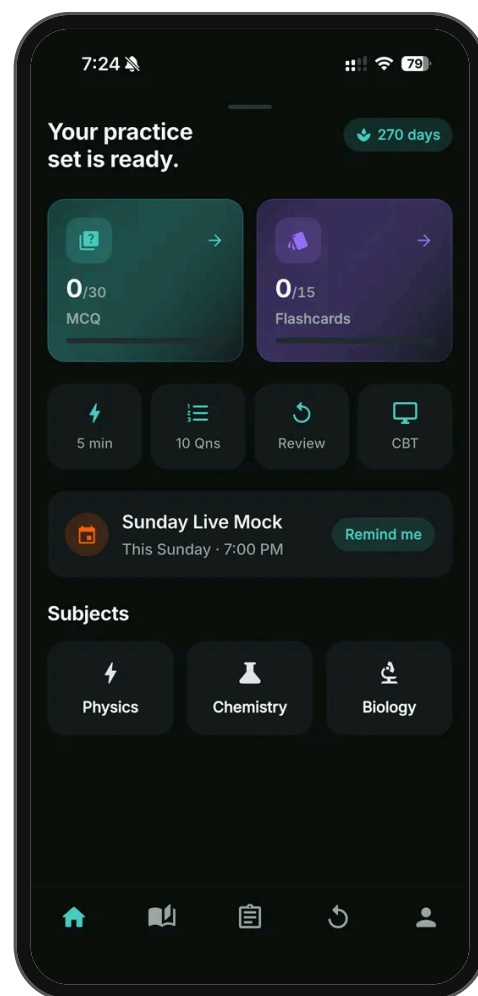
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CHEMISTRY

91. Sucrose on hydrolysis gives

- (1) α -D-Glucose + β -D-Glucose
- (2) α -D-Glucose + β -D-Fructose
- (3) α -D-Fructose + β -D-Fructose
- (4) β -D-Glucose + α -D-Fructose

Answer (2)

Sol. Sucrose is made of an α -D-glucose unit and a β -D-fructose unit joined through a glycosidic bond. On hydrolysis, this bond breaks to give glucose and fructose. The NEET 2020 keyed pair is α -D-glucose and β -D-fructose.

92. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is

Statement I: β -Elimination reaction

Statement II: Follows Zaitsev rule

Statement III: Dehydrohalogenation reaction

Statement IV: Dehydration reaction

- (1) (I), (III), (IV) (2) (II), (III), (IV)
- (3) (I), (II), (IV) (4) (I), (II), (III)

Answer (4)

Sol. The elimination reaction of 2-Bromo-pentane to form pent-2-ene is a β -elimination reaction, follows Zaitsev's rule, and is a dehydrohalogenation reaction. Dehydration involves removing a water molecule, which is not the case here. Chapter: Haloalkanes and Haloarenes.

93. The number of Faradays (F) required to produce 20 g of calcium from molten CaCl_2 (atomic mass of Ca = 40 g mol⁻¹) is

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

Answer (4)

Sol. The reaction for the production of calcium is $\text{Ca}^{2+} + 2\text{e}^- \rightarrow \text{Ca}$. The number of moles of calcium produced is $\frac{20 \text{ g}}{40 \text{ g mol}^{-1}} = 0.5 \text{ mol}$. Since 2 moles of electrons are required to produce 1 mole of calcium, the number of Faradays required is $0.5 \times 2 = 1 \text{ F}$. Chapter: Electrochemistry.

94. An element has a body-centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is

- (1) $\frac{\sqrt{2}}{4} \times 288 \text{ pm}$ (2) $\frac{4}{\sqrt{3}} \times 288 \text{ pm}$
- (3) $\frac{4}{\sqrt{2}} \times 288 \text{ pm}$ (4) $\frac{\sqrt{3}}{4} \times 288 \text{ pm}$

Answer (4)

Sol. For a body-centered cubic (bcc) structure, the relationship between the atomic radius r and the cell edge a is given by $r = \frac{\sqrt{3}}{4}a$. Substituting $a = 288 \text{ pm}$, we get $r = \frac{\sqrt{3}}{4} \times 288 \text{ pm} = \frac{288 \text{ pm}}{4} \times \sqrt{3}$. Chapter: The Solid State.

95. HCl was passed through a solution of CaCl_2 , MgCl_2 and NaCl . Which of the following compound(s) crystallise(s)?

- (1) Only NaCl
- (2) Only MgCl_2
- (3) NaCl , MgCl_2 and CaCl_2
- (4) Both MgCl_2 and CaCl_2

Answer (1)

Sol. Passing HCl gas increases the concentration of Cl^- ions and lowers the solubility of the chlorides by the common-ion effect. Under these conditions, NaCl becomes much less soluble and crystallises, while MgCl_2 and CaCl_2 remain in solution.

96. Find out the solubility of Ni(OH)_2 in 0.1 M NaOH . Given that the ionic product of Ni(OH)_2 is 2×10^{-15} .

- (1) $2 \times 10^{-8} \text{ M}$ (2) $1 \times 10^{-13} \text{ M}$
- (3) $1 \times 10^8 \text{ M}$ (4) $2 \times 10^{-13} \text{ M}$

Answer (4)

Sol. The solubility of Ni(OH)_2 in 0.1 M NaOH can be calculated using the solubility product $K_{sp} = 2 \times 10^{-15}$. Let s be the solubility of Ni(OH)_2 . The concentration of OH^- from NaOH is 0.1 M, and from Ni(OH)_2 is $2s$. Thus, $K_{sp} = s \times (0.1 + 2s)^2 \approx s \times (0.1)^2 = 2 \times 10^{-15} \Rightarrow s = 2 \times 10^{-13} \text{ M}$. Chapter: Equilibrium.

97. For the reaction $2\text{Cl(g)} \rightarrow \text{Cl}_2\text{(g)}$, the correct option is

- (1) $\Delta_r H > 0$ and $\Delta_r S < 0$
- (2) $\Delta_r H < 0$ and $\Delta_r S > 0$
- (3) $\Delta_r H < 0$ and $\Delta_r S < 0$
- (4) $\Delta_r H > 0$ and $\Delta_r S > 0$

Answer (3)

Sol. The reaction $2\text{Cl(g)} \rightarrow \text{Cl}_2\text{(g)}$ involves the formation of a bond, which releases energy, making $\Delta_r H < 0$. Additionally, the reaction decreases the number of gas molecules, reducing entropy, so $\Delta_r S < 0$. Chapter: Chemical Thermodynamics.

98. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

- (1) $\text{SCN}^- < \text{F}^- < \text{CN}^- < \text{C}_2\text{O}_4^{2-}$
- (2) $\text{F}^- < \text{SCN}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$
- (3) $\text{CN}^- < \text{C}_2\text{O}_4^{2-} < \text{SCN}^- < \text{F}^-$
- (4) $\text{SCN}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$

Answer (4)

Sol. In the spectrochemical series relevant here, ligand field strength rises as $\text{SCN}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$. Chapter: Coordination Compounds.

99. The calculated spin-only magnetic moment of Cr^{2+} ion is

- | | | | |
|----------|----------|----------|----------|
| (1) 4.90 | (2) 5.92 | (3) 2.84 | (4) 3.87 |
| BM | BM | BM | BM |

Answer (1)

Sol. The spin-only magnetic moment μ is given by $\mu = \sqrt{n(n+2)} \text{ BM}$, where n is the number of unpaired electrons. For Cr^{2+} , the electronic configuration is $3d^4$, with 4 unpaired electrons. Substituting $n = 4$, $\mu = \sqrt{4(4+2)} = \sqrt{24} \approx 4.90 \text{ BM}$. Chapter: Coordination Compounds.

100. Which of the following set of molecules will have zero dipole moment?

- (1) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene
- (2) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene
- (3) Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene
- (4) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene

Answer (3)

Sol. Boron trifluoride, beryllium difluoride, and carbon dioxide have symmetrical structures leading to zero net dipole moments. 1,4-dichlorobenzene also has a symmetrical structure, making the net dipole moment zero. Chapter: Chemical Bonding and Molecular Structure.

101. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.

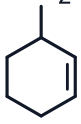
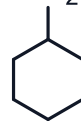
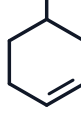
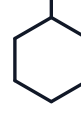
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| (1) Copper | (2) Calcium |
| (3) Potassium | (4) Iron |

Answer (3)

Sol. Potassium ions (K^+) activate many enzymes, participate in the oxidation of glucose to produce

adenosine triphosphate (ATP), and, along with sodium ions (Na^+), are crucial for the transmission of nerve signals. Chapter: The s-Block Elements.

102. An alkene on ozonolysis gives methanal as one of the product. Its structure is

- | | |
|--|---|
| (1)  | (2)  |
| (3)  | (4)  |

Answer (2)

Sol. Methanal is formed only when ozonolysis cleaves a terminal $=\text{CH}_2$ group. Allylcyclohexane contains $-\text{CH}_2-\text{CH}=\text{CH}_2$, so its terminal carbon gives HCHO . Chapter: Hydrocarbons.

Why the other options are wrong:

- (1) 3-Propylcyclohexene: its only double bond is inside the ring, so ozonolysis opens the ring into one dialdehyde and gives no methanal.
- (3) 4-Propylcyclohexene: ozonolysis cleaves the ring double bond and gives a single dialdehyde, with no terminal $=\text{CH}_2$ to give methanal.
- (4) 1-Cyclohexylpropene: ozonolysis splits it into cyclohexanecarbaldehyde and ethanal (CH_3CHO), not methanal.

103. The rate constant for a first order reaction is $4.606 \times 10^{-3} \text{ s}^{-1}$. The time required to reduce 2.0 g of the reactant to 0.2 g is :

- | | | | |
|-----------|-----------|------------|-----------|
| (1) 200 s | (2) 500 s | (3) 1000 s | (4) 100 s |
|-----------|-----------|------------|-----------|

Answer (2)

Sol. For a first-order reaction, $t = \frac{2.303}{k} \log \left(\frac{[A]_0}{[A]} \right)$.

Substituting, $t = \frac{2.303}{4.606 \times 10^{-3}} \log \left(\frac{2.0}{0.2} \right) = \frac{2.303}{4.606 \times 10^{-3}} \log 10 = \frac{2.303}{4.606 \times 10^{-3}} \times 1 = 500 \text{ s}$. Chapter: Chemical Kinetics.

104. Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give :

- | | |
|------------------------|-------------------------|
| (1) Sec. butyl alcohol | (2) Tert. butyl alcohol |
| (3) Isobutyl alcohol | (4) Isopropyl alcohol |

Answer (2)

Sol. The reaction of acetone with methylmagnesium chloride forms a tertiary alkoxide, which upon hydrolysis yields tert-butyl alcohol. This follows the

Grignard reagent mechanism where the nucleophilic attack occurs at the carbonyl carbon, leading to the formation of a tertiary alcohol. Chapter: Aldehydes, Ketones and Carboxylic Acids.

105. Which of the following is a natural polymer?

- (1) poly (Butadiene-styrene)
- (2) polybutadiene
- (3) poly (Butadiene-acrylonitrile)
- (4) cis-1, 4-polyisoprene

Answer (4)

Sol. cis-1,4-polyisoprene is the natural polymer found in rubber latex, derived from rubber trees. Other options are synthetic polymers. Chapter: Polymers.

106. Identify the correct statements from the following :

Statement I: $\text{CO}_2(\text{g})$ is used as refrigerant for ice-cream and frozen food.

Statement II: The structure of C_{60} contains twelve six carbon rings and twenty five carbon rings.

Statement III: ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.

Statement IV: CO is colorless and odourless gas.

- (1) (I) and (III) only
- (2) (II) and (III) only
- (3) (III) and (IV) only
- (4) (I), (II) and (III) only

Answer (3)

Sol. CO_2 gas is not the refrigerant used here; solid CO_2 (dry ice) is. C_{60} contains twelve five-membered and twenty six-membered rings, so (Statement II) is false. ZSM-5 converts alcohols to gasoline and CO is colourless and odourless, so only (Statement III) and (Statement IV) are correct. Chapter: p-Block Elements (Groups 13-14).

107. The correct option for free expansion of an ideal gas under adiabatic condition is

- (1) $q = 0$, $\Delta T < 0$ and $w > 0$
- (2) $q < 0$, $\Delta T = 0$ and $w = 0$
- (3) $q > 0$, $\Delta T > 0$ and $w > 0$
- (4) $q = 0$, $\Delta T = 0$ and $w = 0$

Answer (4)

Sol. In a free expansion of an ideal gas under adiabatic conditions, no work is done ($w = 0$) and no heat is exchanged ($q = 0$). Since the internal energy of an ideal gas depends only on temperature, $\Delta T = 0$. Chapter: Chemical Thermodynamics.

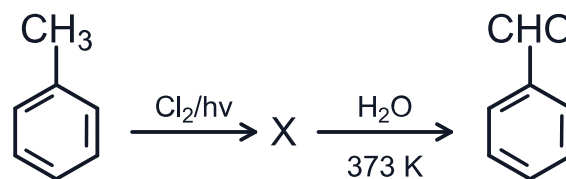
108. Which of the following oxoacid of sulphur has - O - O - linkage?

- (1) H_2SO_4 , sulphuric acid
- (2) $\text{H}_2\text{S}_2\text{O}_8$, peroxodisulphuric acid
- (3) $\text{H}_2\text{S}_2\text{O}_7$, pyrosulphuric acid
- (4) H_2SO_3 , sulphurous acid

Answer (2)

Sol. Peroxodisulphuric acid ($\text{H}_2\text{S}_2\text{O}_8$) contains the peroxide linkage (-O-O-), which is not present in the other oxoacids listed. Chapter: p-Block Elements (Groups 15-18).

109. Identify compound X in the following sequence of reactions



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

Answer (2)

Sol. Successive side-chain chlorination of toluene under light gives benzal chloride, $\text{C}_6\text{H}_5\text{CHCl}_2$. Hydrolysis at 373 K converts its gem-dichloride group to -CHO, forming benzaldehyde. Chapter: Hydrocarbons.

Why the other options are wrong:

- (1) Benzyl chloride, $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$: hydrolysis swaps its single Cl for OH and gives benzyl alcohol, not benzaldehyde.
- (3) Benzotrichloride, $\text{C}_6\text{H}_5\text{CCl}_3$: hydrolysis turns the CCl_3 group into -COOH and gives benzoic acid, not benzaldehyde.
- (4) Chlorobenzene: it has no side-chain carbon to become -CHO, and Cl_2 in light chlorinates the side chain, not the ring.

110. The number of protons, neutrons and electrons in ${}_{71}^{175}\text{Lu}$, respectively, are

- (1) 104, 71 and 71 (2) 71, 71 and 104
(3) 175, 104 and 71 (4) 71, 104 and 71

Answer (4)

Sol. The atomic number (71) gives the number of protons and electrons, and the mass number (175) minus the atomic number gives the number of neutrons: $175 - 71 = 104$. Chapter: Structure of Atom.

111. Identify the incorrect statement.

- (1) Transition metals and their compounds are known for catalytic activity because they can adopt multiple oxidation states and form complexes.
(2) Interstitial compounds form when small atoms such as H, C or N occupy spaces in metal crystal lattices.
(3) The oxidation states of chromium in CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$ are not the same.
(4) Cr^{2+} (d^4) is a stronger reducing agent than Fe^{2+} (d^6) in water.

Answer (3)

Sol. Chromium is +6 in both CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$, so the statement that their oxidation states differ is incorrect. The other three statements are valid. Chapter: The d- and f-Block Elements.

112. Which of the following is a cationic detergent?

- (1) Sodium stearate
(2) Cetyltrimethyl ammonium bromide
(3) Sodium dodecylbenzene sulphonate
(4) Sodium lauryl sulphate

Answer (2)

Sol. Cetyltrimethyl ammonium bromide is a cationic detergent because it has a positively charged quaternary ammonium ion. Sodium lauryl sulphate, sodium stearate, and sodium dodecylbenzene sulphonate are anionic detergents. Chapter: Chemistry in Everyday Life.

113. The freezing point depression constant (K_f) of benzene is $5.12 \text{ K kg mol}^{-1}$. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places) :

- (1) 0.80 K (2) 0.40 K (3) 0.60 K (4) 0.20 K

Answer (2)

Sol. The freezing point depression ΔT_f is given by $\Delta T_f = K_f \times m$. Substituting the values, $\Delta T_f = 5.12 \times 0.078 = 0.40 \text{ K}$. Chapter: Solutions.

114. Identify the incorrect match.

List I	List II
P) Unnilunium	I) Mendeleevium
Q) Unniltrium	II) Lawrencium
R) Unnilhexium	III) Seaborgium
S) Unununnium	IV) Darmstadtium

- (1) Q-II (2) R-III (3) S-IV (4) P-I

Answer (3)

Sol. Unnilunium, unniltrium and unnilhexium correctly correspond to elements 101, 103 and 106. The printed 'Unununnium' denotes element 111, whose official name is roentgenium, not darmstadtium; therefore S-IV is the incorrect match. Chapter: Classification of Elements and Periodicity in Properties.

115. The mixture which shows positive deviation from Raoult's law is

- (1) Benzene + Toluene
(2) Acetone + Chloroform
(3) Chloroethane + Bromoethane
(4) Ethanol + Acetone

Answer (4)

Sol. Ethanol and acetone show positive deviation from Raoult's law due to weaker intermolecular interactions in the solution compared to pure components. Chapter: Solutions.

116. Match each oxide with its nature and select the correct option.

List I	List II
P) CO	I) Basic
Q) BaO	II) Neutral
R) Al_2O_3	III) Acidic
S) Cl_2O_7	IV) Amphoteric

- (1) P-II, Q-I, R-IV, S-III (2) P-III, Q-IV, R-I, S-II
(3) P-IV, Q-III, R-II, S-I (4) P-I, Q-II, R-III, S-IV

Answer (1)

Sol. CO is neutral, BaO basic, Al_2O_3 amphoteric and Cl_2O_7 acidic. Thus P-II, Q-I, R-IV, S-III. Chapter: Classification of Elements and Periodicity in Properties.

117. Which one of the followings has maximum number of atoms ?

- (1) 1 g of Mg(s) [Atomic mass of Mg = 24]
(2) $1 \text{ g of O}_2(\text{g})$ [Atomic mass of O = 16]
(3) 1 g of Li(s) [Atomic mass of Li = 7]
(4) 1 g of Ag(s) [Atomic mass of Ag = 108]

Answer (3)

Sol. To find the number of atoms, use $n = \frac{m}{M} \times N_A$, where m is mass, M is molar mass, and N_A is Avogadro's number. For 1 g of each: - Ag: $\frac{1}{108} \times N_A$ - Mg: $\frac{1}{24} \times N_A$ - O₂: $\frac{1}{32} \times 2 \times N_A = \frac{1}{16} \times N_A$ (since O₂ has a molar mass of 32 g/mol and two atoms per molecule) - Li: $\frac{1}{7} \times N_A$ Li has the highest number of atoms. Chapter: Some Basic Concepts of Chemistry.

118. Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as

- (1) Cannizzaro's reaction
- (2) Cross Cannizzaro's reaction
- (3) Cross Aldol condensation
- (4) Aldol condensation

Answer (3)

Sol. The reaction between benzaldehyde and acetophenone in the presence of dilute NaOH is a cross aldol condensation. This reaction involves the condensation of an aldehyde with a ketone to form a β -hydroxy ketone. Chapter: Aldehydes, Ketones and Carboxylic Acids.

119. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following ?

- (1) + R effect of - CH₃ groups
- (2) - R effect of - CH₃ groups
- (3) Hyperconjugation
- (4) - I effect of - CH₃ groups

Answer (3)

Sol. A tertiary butyl carbocation is more stable than a secondary butyl carbocation due to hyperconjugation, which involves the delocalization of σ -bond electrons into the empty p-orbital of the carbocation. This effect increases the stability of the carbocation. Chapter: Organic Chemistry: Some Basic Principles and Techniques.

120. Which of the following is not correct about carbon monoxide ?

- (1) It reduces oxygen carrying ability of blood.
- (2) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.
- (3) It is produced due to incomplete combustion.
- (4) It forms carboxyhaemoglobin

Answer (2)

Sol. CO reduces oxygen transport by forming carboxyhaemoglobin, which is more stable than oxyhaemoglobin. It is also produced by incomplete combustion, so the claim that carboxyhaemoglobin is

less stable is the incorrect statement. Chapter: Environmental Chemistry.

121. Which of the following is a basic amino acid ?

- | | |
|-------------|--------------|
| (1) Alanine | (2) Tyrosine |
| (3) Lysine | (4) Serine |

Answer (3)

Sol. Lysine is a basic amino acid due to the presence of an additional amino group ($-\text{NH}_2$) in its side chain, making it positively charged at physiological pH. Chapter: Biomolecules.

122. Urea reacts with water to form A, which decomposes to form B. When B is passed through Cu²⁺(aq), a deep-blue solution C is formed. What is the formula of C?

- | | |
|--|-------------------------|
| (1) [Cu(NH ₃) ₄] ²⁺ | (2) Cu(OH) ₂ |
| (3) CuCO ₃ ·Cu(OH) ₂ | (4) CuSO ₄ |

Answer (1)

Sol. Urea hydrolysis ultimately releases NH₃. Excess ammonia coordinates Cu²⁺ to form the deep-blue tetraamminecopper(II) ion [Cu(NH₃)₄]²⁺. Chapter: Coordination Compounds.

123. A mixture of N₂ and Ar gases in a cylinder contains 7 g of N₂ and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of N₂ is : [Use atomic masses (in g mol⁻¹) : N = 14, Ar = 40]

- | | | | |
|------------|------------|------------|-----------|
| (1) 12 bar | (2) 15 bar | (3) 18 bar | (4) 9 bar |
|------------|------------|------------|-----------|

Answer (2)

Sol. Calculate the number of moles of each gas: $n_{N_2} = \frac{7}{28} = 0.25$ mol, $n_{Ar} = \frac{8}{40} = 0.2$ mol. The total number of moles is $0.25 + 0.2 = 0.45$ mol. The partial pressure of N₂ is given by $P_{N_2} = \frac{n_{N_2}}{n_{total}} \times P_{total} = \frac{0.25}{0.45} \times 27 = 15$ bar. Chapter: States of Matter.

124. Identify the correct statement from the following :

- (1) Blister copper has blistered appearance due to evolution of CO₂.
- (2) Vapour phase refining is carried out for Nickel by Van Arkel method.
- (3) Pig iron can be moulded into a variety of shapes.
- (4) Wrought iron is impure iron with 4% carbon.

Answer (3)

Sol. Pig iron can be moulded into a variety of shapes due to its high carbon content and low melting point. Chapter: General Principles and Processes of Isolation of Elements.

125. Hydrolysis of sucrose is given by: $\text{sucrose} + \text{H}_2\text{O} \rightleftharpoons \text{glucose} + \text{fructose}$. If the equilibrium constant (K_c) is 2×10^{13} at 300 K, the value of $\Delta_r G^\circ$ at the same temperature will be

- (1) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
 (2) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$
 (3) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$
 (4) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

Answer (4)

Sol. The relationship between the equilibrium constant K_c and the standard Gibbs free energy change $\Delta_r G^\circ$ is given by $\Delta_r G^\circ = -RT \ln K_c$. Substituting the values, $\Delta_r G^\circ = -8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$. Chapter: Equilibrium.

126. Identify a molecule which does not exist.

- (1) Li_2 (2) C_2 (3) O_2 (4) He_2

Answer (4)

Sol. He_2 does not exist because helium atoms have a complete outer shell and do not form stable bonds with each other. In contrast, Li_2 , C_2 , and O_2 can form stable molecules. Chapter: Chemical Bonding and Molecular Structure.

127. An increase in the concentration of the reactants of a reaction leads to change in

- (1) heat of reaction (2) threshold energy
 (3) collision frequency (4) activation energy

Answer (3)

Sol. An increase in the concentration of reactants leads to a higher collision frequency, as more particles are available to collide. This does not affect activation energy, heat of reaction, or threshold energy. Chapter: Chemical Kinetics.

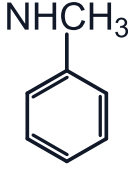
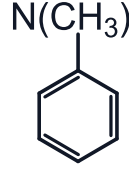
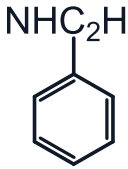
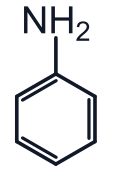
128. Which of the following alkane cannot be made in good yield by Wurtz reaction?

- (1) 2,3-Dimethylbutane (2) n-Heptane
 (3) n-Butane (4) n-Hexane

Answer (2)

Sol. A Wurtz reaction with one alkyl halide gives a symmetrical alkane with an even total carbon count. Making n-heptane requires two different halides, producing a mixture, so it cannot be obtained in good yield. Chapter: Hydrocarbons.

129. Which of the following amine will give the carbylamine test?

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

Answer (4)

Sol. Only primary amines give the carbylamine test. Aniline is primary, whereas N-methyl-, N-ethyl- and N,N-dimethylaniline are secondary or tertiary. Chapter: Amines.

Why the other options are wrong:

- (1) N-methylaniline is a secondary amine with only one N-H, and an isocyanide needs two N-H hydrogens to form with CHCl_3 and alcoholic KOH.
- (2) N,N-dimethylaniline is a tertiary amine with no N-H at all, so no isocyanide can form.
- (3) N-ethylaniline is a secondary amine; its single N-H is not enough to give the foul-smelling isocyanide.

130. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be

- (1) Oxygen gas (2) H_2S gas
 (3) SO_2 gas (4) Hydrogen gas

Answer (1)

Sol. On electrolysis of dilute sulfuric acid with platinum electrodes, oxygen gas is evolved at the anode due to the oxidation of water. The reaction is $2\text{H}_2\text{O} \rightarrow \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$. Chapter: Electrochemistry.

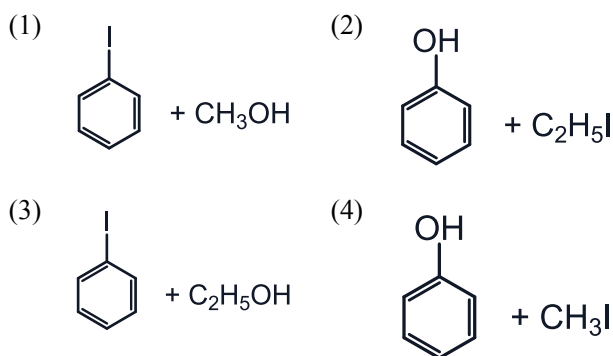
131. What is the change in oxidation number of carbon in the reaction $\text{CH}_4(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{CCl}_4(\text{l}) + 4\text{HCl}(\text{g})$?

- (1) 0 to +4 (2) -4 to +4
 (3) 0 to -4 (4) +4 to +4

Answer (2)

Sol. In CH_4 , the oxidation number of carbon is -4 (since hydrogen is +1). In CCl_4 , the oxidation number of carbon is +4 (since chlorine is -1). Thus, the change in oxidation number of carbon is from -4 to +4. Chapter: Redox Reactions.

132. Anisole on cleavage with HI gives



Answer (4)

Sol. HI protonates anisole at oxygen, then I⁻ attacks the methyl group by substitution nucleophilic bimolecular (S_N2) cleavage. The products are phenol and methyl iodide (CH₃I); the aryl C-O bond is not cleaved by S_N2. Chapter: Alcohols, Phenols and Ethers.

Why the other options are wrong:

- (1) Iodobenzene and CH₃OH: this needs I⁻ to attack the ring carbon, but S_N2 cannot occur at an sp² aryl carbon, so the aryl C-O bond stays intact.
- (2) Phenol and C₂H₅I: anisole is a methyl ether, so the alkyl iodide formed is CH₃I; ethyl iodide would come from phenetole.
- (3) Iodobenzene and C₂H₅OH: the aryl C-O bond is not broken, and anisole has no ethyl group to give ethanol.

133. Measuring Zeta potential is useful in determining which property of colloidal solution?

- (1) Solubility
- (2) Stability of the colloidal particles
- (3) Size of the colloidal particles
- (4) Viscosity

Answer (2)

Sol. Measuring Zeta potential is useful in determining the stability of colloidal particles, as it indicates the degree of repulsion between adjacent particles. Higher Zeta potential values lead to greater stability by preventing particle aggregation. Chapter: Surface Chemistry.

134. Paper chromatography is an example of

- (1) Partition chromatography
- (2) Thin layer chromatography
- (3) Column chromatography
- (4) Adsorption chromatography

Answer (1)

Sol. Paper chromatography is a type of partition chromatography where the stationary phase is the water bound to the cellulose fibers of the paper, and

the mobile phase is the solvent. Chapter: Surface Chemistry.

135. Match the following and identify the correct option.

List I	List II
P) CO(g) + H ₂ (g)	I) Mg(HCO ₃) ₂ + Ca(HCO ₃) ₂
Q) Temporary hardness of water	II) An electron-deficient hydride
R) B ₂ H ₆	III) Synthesis gas
S) H ₂ O ₂	IV) Non-planar structure

- (1) P-III, Q-II, R-I, S-IV (2) P-III, Q-IV, R-II, S-I
 (3) P-I, Q-III, R-II, S-IV (4) P-III, Q-I, R-II, S-IV

Answer (4)

Sol. CO + H₂ is synthesis gas; temporary hardness comes from Ca/Mg bicarbonates; B₂H₆ is electron deficient; and H₂O₂ is non-planar. Thus P-III, Q-I, R-II, S-IV. Chapter: Hydrogen.

PHYSICS

136. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is $\pi/3$. If instead C is removed from the circuit, the phase difference is again $\pi/3$ between current and voltage. The power factor of the circuit is

- (1) 0.5 (2) 1.0 (3) -1.0 (4) zero

Answer (2)

Sol. For the RC circuit, $\tan(\pi/3) = X_C/R$; for the RL circuit, $\tan(\pi/3) = X_L/R$. Hence $X_L = X_C$ in the complete series circuit, so it is at resonance and its power factor is $\cos 0 = 1$. Chapter: Alternating Current.

137. A wire of length L, area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is

- (1) $Mg(L_1 - L)/(AL)$ (2) $MgL/(AL_1)$
 (3) $MgL/[A(L_1 - L)]$ (4) $MgL_1/(AL)$

Answer (3)

Sol. Young's modulus $Y = \frac{\text{Stress}}{\text{Strain}} = \frac{F/A}{\Delta L/L}$. Substituting,
 $Y = \frac{Mg}{A} \times \frac{L}{L_1 - L} = \frac{MgL}{A(L_1 - L)}$. Chapter: Mechanical Properties of Solids.

138. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is ($\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$)

- (1) $3.14 \times 10^{-4} \text{ T}$ (2) $6.28 \times 10^{-5} \text{ T}$
 (3) $3.14 \times 10^{-5} \text{ T}$ (4) $6.28 \times 10^{-4} \text{ T}$

Answer (4)

Sol. The magnetic field B inside a solenoid is given by $B = \mu_0 \frac{N}{L} I$. Substituting the values, $B = 4\pi \times 10^{-7} \times \frac{100}{0.5} \times 2.5 = 6.28 \times 10^{-4} \text{ T}$. Chapter: Moving Charges and Magnetism.

139. A ray is incident at an angle of incidence i on one surface of a small angle prism (with angle of prism A) and emerges normally from the opposite surface. If the refractive index of the material of the prism is μ , then the angle of incidence is nearly equal to

- (1) $2A/\mu$ (2) μA (3) $\mu A/2$ (4) $A/(2\mu)$

Answer (2)

Sol. Because the ray emerges normally, the second internal angle is zero and the first is approximately the prism angle A. For a small angle, Snell's law gives $i \approx \mu A$. Chapter: Ray Optics and Optical Instruments.

140. In a certain region of space with volume 0.2 m^3 , the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is :

- (1) 0.5 N/C (2) 1 N/C (3) 5 N/C (4) zero

Answer (4)

Sol. Electric field is the negative spatial gradient of potential. A constant 5 V everywhere in the region has zero gradient, so the field is zero. Chapter: Electrostatic Potential and Capacitance.

141. For which one of the following, Bohr model is not valid ?

- (1) Singly ionised helium atom (He^+)
 (2) Deuteron atom
 (3) Singly ionised neon atom (Ne^+)
 (4) Hydrogen atom

Answer (3)

Sol. The Bohr model is valid for hydrogen-like atoms, which have one electron. Hydrogen, singly ionised helium, and deuteron all fit this criterion. Singly ionised neon, however, has more than one electron, making the Bohr model inapplicable. Chapter: Atoms.

142. Light with an average flux of 20 W cm^{-2} falls on a non-reflecting surface at normal incidence having surface area 20 cm^2 . The energy received by the surface during a time span of 1 minute is

- (1) $12 \times 10^3 \text{ J}$ (2) $24 \times 10^3 \text{ J}$
 (3) $48 \times 10^3 \text{ J}$ (4) $10 \times 10^3 \text{ J}$

Answer (2)

Sol. The energy received is given by $E = \text{flux} \times \text{area} \times \text{time}$. Substituting, $E = 20 \text{ W/cm}^2 \times 20 \text{ cm}^2 \times 60 \text{ s} = 24 \times 10^3 \text{ J}$. Chapter: Electromagnetic Waves.

143. An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is $1.227 \times 10^{-2} \text{ nm}$, the potential difference is

- (1) 10^2 V (2) 10^3 V (3) 10^4 V (4) 10 V

Answer (3)

Sol. For an electron, $\lambda(\text{nm}) = 1.227/\sqrt{V}$. Setting $\lambda = 1.227 \times 10^{-2} \text{ nm}$ gives $\sqrt{V} = 100$ and $V = 10^4 \text{ V}$. Chapter: Dual Nature of Radiation and Matter.

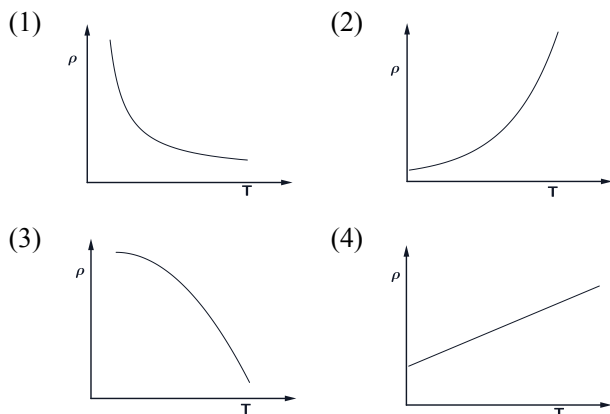
144. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

- (1) 32 N (2) 30 N (3) 24 N (4) 48 N

Answer (1)

Sol. The gravitational force at a height h from the Earth's surface is given by $F = \frac{mgR^2}{(R+h)^2}$. For $h = \frac{R}{2}$, $F = \frac{mgR^2}{(R+\frac{R}{2})^2} = \frac{mgR^2}{(\frac{3R}{2})^2} = \frac{4}{9} \times mg$. Since $mg = 72 \text{ N}$, $F = \frac{4}{9} \times 72 = 32 \text{ N}$. Chapter: Gravitation.

145. Which of the following graph represents the variation of resistivity (ρ) with temperature (T) for copper?

**Answer (2)**

Sol. For copper, resistivity rises with temperature and is nearly linear over a limited ordinary-temperature range, but bends appreciably at very low temperatures. The source curve with that behaviour is option (2). Chapter: Current Electricity.

Why the other options are wrong:

- (1) Resistivity falling steeply and then levelling off as temperature rises is how a semiconductor behaves, not a metal like copper.
- (3) This curve shows resistivity decreasing with temperature, but the resistivity of copper increases with temperature.
- (4) A straight line treats copper as linear at every temperature, but the linear relation holds only over a limited range and the real curve bends at low temperatures.

146. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?

- (1) four times (2) one-fourth
(3) zero (4) doubled

Answer (3)

Sol. The new frequency is $0.75\nu_0$, below the threshold ν_0 . No electrons are emitted irrespective of the doubled intensity, so the photoelectric current is zero. Chapter: Dual Nature of Radiation and Matter.

147. A $40 \mu\text{F}$ capacitor is connected to a 200 V , 50 Hz ac supply. The rms value of the current in the circuit is, nearly

- (1) 2.05 A (2) 2.5 A (3) 25.1 A (4) 1.7 A

Answer (2)

Sol. For a capacitor, $I = V(2\pi fC) = 200 \times 2\pi \times 50 \times 40 \times 10^{-6} \approx 2.51 \text{ A}$, matching 2.5 A . Chapter: Alternating Current.

148. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of a telescope whose objective diameter is 2 m is

- (1) $1.83 \times 10^{-7} \text{ rad}$ (2) $7.32 \times 10^{-7} \text{ rad}$
(3) $6.00 \times 10^{-7} \text{ rad}$ (4) $3.66 \times 10^{-7} \text{ rad}$

Answer (4)

Sol. The limit of resolution θ for a telescope is given by $\theta = 1.22 \frac{\lambda}{D}$. Substituting the values, $\theta = 1.22 \frac{600 \times 10^{-9}}{2} = 3.66 \times 10^{-7} \text{ rad}$. Chapter: Ray Optics and Optical Instruments.

149. A ball is thrown vertically downward with a velocity of 20 m s^{-1} from the top of a tower. It hits the ground after some time with a velocity of 80 m s^{-1} . The height of the tower is ($g = 10 \text{ m s}^{-2}$)

- (1) 340 m (2) 320 m (3) 300 m (4) 360 m

Answer (3)

Sol. Using $v^2 = u^2 + 2gh$ gives $h = (80^2 - 20^2)/(2 \times 10) = 300 \text{ m}$. Chapter: Motion in a Straight Line.

150. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C . Its density is ($R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$)

- (1) 0.2 kg m^{-3} (2) 0.1 kg m^{-3}
(3) 0.02 kg m^{-3} (4) 0.5 kg m^{-3}

Answer (1)

Sol. The density ρ of an ideal gas is given by $\rho = \frac{P \times M}{R \times T}$, where P is the pressure, M is the molar mass, R is the gas constant, and T is the temperature in Kelvin. Substituting the values, $P = 249 \times 10^3 \text{ Pa}$, $M = 2 \times 10^{-3} \text{ kg/mol}$, $R = 8.3 \text{ J/mol K}$, and $T = 27 + 273 = 300 \text{ K}$, we get $\rho = \frac{249 \times 10^3 \times 2 \times 10^{-3}}{8.3 \times 300} \approx 0.2 \text{ kg/m}^3$. Chapter: Kinetic Theory.

151. When a uranium isotope ${}^{235}_{92}\text{U}$ is bombarded with a neutron, it generates ${}^{89}_{36}\text{Kr}$, three neutrons and

- (1) ${}^{91}_{40}\text{Zr}$ (2) ${}^{101}_{36}\text{Kr}$
(3) ${}^{103}_{36}\text{Kr}$ (4) ${}^{144}_{56}\text{Ba}$

Answer (4)

Sol. The nuclear reaction is ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{89}_{36}\text{Kr} + 3 {}^1_0\text{n} + {}^{144}_{56}\text{Ba}$. The mass and charge numbers must be

conserved, so the remaining product is ${}_{56}^{144}\text{Ba}$.

Chapter: Nuclei.

152. The increase in the width of the depletion region in a p-n junction diode is due to :

- (1) reverse bias only
- (2) both forward bias and reverse bias
- (3) increase in forward current
- (4) forward bias only

Answer (1)

Sol. The width of the depletion region increases under reverse bias, as the applied voltage enhances the electric field and repels more majority carriers away from the junction. Chapter: Semiconductor Electronics.

153. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is

- (1) $3\pi/2$ rad
- (2) $\pi/2$ rad
- (3) zero
- (4) π rad

Answer (4)

Sol. In SHM, $a = -\omega^2 x$. Acceleration is therefore exactly opposite to displacement, giving a phase difference of π radians. Chapter: Oscillations.

154. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m^{-1} . The permeability of the material is ($\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$)

- (1) $8.0 \times 10^{-5} \text{ T m A}^{-1}$
- (2) $2.4\pi \times 10^{-5} \text{ T m A}^{-1}$
- (3) $2.4\pi \times 10^{-7} \text{ T m A}^{-1}$
- (4) $2.4\pi \times 10^{-4} \text{ T m A}^{-1}$

Answer (4)

Sol. Permeability is $\mu = \mu_0(1 + \chi) = 4\pi \times 10^{-7} \times 600 = 2.4\pi \times 10^{-4} \text{ T m A}^{-1}$. Chapter: Magnetism and Matter.

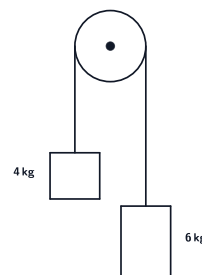
155. The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5r_2$) through 1 K are in the ratio

- (1) 9/4
- (2) 3/2
- (3) 5/3
- (4) 27/8

Answer (4)

Sol. The heat required to raise the temperature of a sphere is proportional to its volume, which is proportional to the cube of its radius. Given $r_1 = 1.5r_2$, the ratio of volumes is $\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{1.5r_2}{r_2}\right)^3 = 1.5^3 = \frac{27}{8}$. Therefore, the ratio of the quantities of heat required is $\frac{27}{8}$. Chapter: Thermal Properties of Matter.

156. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is



- (1) $g/2$
- (2) $g/5$
- (3) $g/10$
- (4) g

Answer (2)

Sol. For a system of two masses m_1 and m_2 connected by a massless string over a frictionless pulley, the acceleration a is given by $a = \frac{(m_2 - m_1)g}{m_1 + m_2}$. Substituting $m_1 = 4 \text{ kg}$ and $m_2 = 6 \text{ kg}$, $a = \frac{(6 - 4)g}{4 + 6} = \frac{2g}{10} = \frac{g}{5}$. Chapter: Laws of Motion.

Why the other options are wrong:

- (1) $g/2$: this divides the net pull $(6 - 4)g = 2g$ by the 4 kg block alone, but both blocks accelerate together, so the full 10 kg must be used.
- (3) $g/10$: this takes the net pull as g , but the unbalanced weight is $(6 - 4)g = 2g$, which gives twice that.
- (4) g : this is free fall. The 4 kg block's weight pulls back against the 6 kg block and the net pull moves all 10 kg, so a must be less than g .

157. The mean free path for a gas, with molecular diameter d and number density n can be expressed as

- (1) $1/(\sqrt{2} n \pi d^2)$
- (2) $1/(\sqrt{2} n^2 \pi d^2)$
- (3) $1/(\sqrt{2} n^2 \pi^2 d^2)$
- (4) $1/(\sqrt{2} n \pi d)$

Answer (1)

Sol. The kinetic-theory expression for mean free path is $\lambda = 1/(\sqrt{2} n \pi d^2)$, where n is number density and d is molecular diameter. Chapter: Kinetic Theory.

158. A short electric dipole has a dipole moment of $16 \times 10^{-9} \text{ C m}$. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is ($1/(4\pi\epsilon_0) = 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$)

- (1) 200 V
- (2) 400 V
- (3) zero
- (4) 50 V

Answer (1)

Sol. The electric potential due to a dipole is given by $V = \frac{1}{4\pi\epsilon_0} \frac{p \cos \theta}{r^2}$. Substituting the values, $V = \frac{9 \times 10^9 \times 16 \times 10^{-9} \times \cos 60^\circ}{(0.6)^2} = \frac{9 \times 16 \times 0.5}{0.36} = 200 \text{ V}$. Chapter: Electrostatic Potential and Capacitance.

159. Dimensions of stress are

- (1) $[ML^2T^{-2}]$ (2) $[ML^0T^{-2}]$
 (3) $[ML^{-1}T^{-2}]$ (4) $[MLT^{-2}]$

Answer (3)

Sol. Stress is defined as force per unit area, with dimensions $\left[\frac{F}{A}\right] = \left[\frac{MLT^{-2}}{L^2}\right] = [ML^{-1}T^{-2}]$. Chapter: Units and Measurements.

160. The energy required to break one bond in DNA is 10^{-20} J . This value in eV is nearly

- (1) 0.6 (2) 0.06 (3) 0.006 (4) 6

Answer (2)

Sol. To convert joules to electron-volts, use the conversion factor $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$. For 10^{-20} J , the energy in eV is $\frac{10^{-20}}{1.6 \times 10^{-19}} \approx 0.06 \text{ eV}$. Chapter: Units and Measurements.

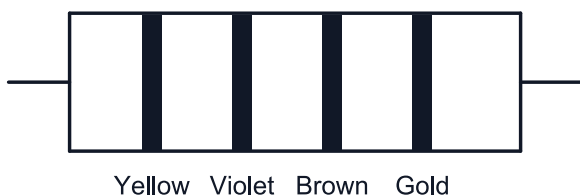
161. In a guitar, two strings A and B made of the same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be

- (1) 524 Hz (2) 536 Hz (3) 537 Hz (4) 523 Hz

Answer (1)

Sol. Initially $|f_B - 530| = 6$. Decreasing B's tension lowers f_B ; because the beat frequency then increases, B was already below 530 Hz. Thus $f_B = 530 - 6 = 524 \text{ Hz}$. Chapter: Waves.

162. The color code of a resistance is given below



The values of resistance and tolerance, respectively, are

- (1) $47 \text{ k}\Omega$, 10% (2) $4.7 \text{ k}\Omega$, 5%
 (3) 470Ω , 5% (4) $470 \text{ k}\Omega$, 5%

Answer (3)

Sol. Yellow and violet give digits 4 and 7, brown is the $\times 10$ multiplier, and gold means $\pm 5\%$. Therefore $R = 47 \times 10 = 470 \Omega$ with 5% tolerance. Chapter: Current Electricity.

Why the other options are wrong:

- (1) $47 \text{ k}\Omega$ would need an orange ($\times 10^3$) multiplier band, and 10% tolerance is a silver band, not gold.
- (2) $4.7 \text{ k}\Omega$ is $47 \times 10^2 \Omega$, which needs a red multiplier band; brown only multiplies by 10.
- (4) $470 \text{ k}\Omega$ is $47 \times 10^4 \Omega$, which needs a yellow multiplier band; brown only multiplies by 10.

163. The Brewster's angle i_B for an interface should be

- (1) $30^\circ < i_B < 45^\circ$ (2) $45^\circ < i_B < 90^\circ$
 (3) $i_B = 90^\circ$ (4) $0^\circ < i_B < 30^\circ$

Answer (2)

Sol. Brewster's angle i_B is given by $\tan i_B = \mu$, where μ is the refractive index of the second medium with respect to the first. Since $\mu > 1$, i_B must be greater than 45° but less than 90° . Chapter: Ray Optics and Optical Instruments.

164. The capacitance of a parallel plate capacitor with air as medium is $6 \mu\text{F}$. With the introduction of a dielectric medium, the capacitance becomes $30 \mu\text{F}$. The permittivity of the medium is ($\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$)

- (1) $1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
 (2) $0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
 (3) $5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
 (4) $0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$

Answer (2)

Sol. The dielectric constant is $30/6 = 5$. Therefore $\epsilon = 5\epsilon_0 = 4.425 \times 10^{-11} = 0.4425 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, matching option (2). Chapter: Electrostatic Potential and Capacitance.

165. Find the torque about the origin when a force $3\hat{j} \text{ N}$ acts on a particle whose position vector is $2\hat{k} \text{ m}$.

- (1) $6\hat{j} \text{ N m}$ (2) $-6\hat{i} \text{ N m}$ (3) $6\hat{k} \text{ N m}$ (4) $6\hat{i} \text{ N m}$

Answer (2)

Sol. Torque $\tau = \mathbf{r} \times \mathbf{F} = (2\hat{k}) \times (3\hat{j}) = 6(\hat{k} \times \hat{j}) = -6\hat{i} \text{ N m}$. Chapter: System of Particles and Rotational Motion.

166. A resistance wire connected in the left gap of a metre bridge balances a 10Ω resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1Ω of the resistance wire is :

- (1) $1.0 \times 10^{-1} \text{ m}$ (2) $1.5 \times 10^{-1} \text{ m}$
 (3) $1.5 \times 10^{-2} \text{ m}$ (4) $1.0 \times 10^{-2} \text{ m}$

Answer (1)

Sol. At balance, $R/10 = 3/2$, so the 1.5 m resistance wire has $R = 15 \Omega$. Its length per ohm is $1.5/15 = 0.10$ m.
Chapter: Current Electricity.

167. For transistor action, which of the following statements is correct?

- (1) Base, emitter and collector regions should have same size.
- (2) Both emitter junction as well as the collector junction are forward biased.
- (3) The base region must be very thin and lightly doped.
- (4) Base, emitter and collector regions should have same doping concentrations.

Answer (3)

Sol. For transistor action, the base region must be very thin and lightly doped to ensure that most of the charge carriers injected from the emitter reach the collector. Chapter: Semiconductor Electronics.

168. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is (c = speed of electromagnetic waves)

- (1) 1 : 1
- (2) 1 : c
- (3) 1 : c^2
- (4) c : 1

Answer (1)

Sol. In an electromagnetic wave the electric and magnetic energy densities are equal because $E = cB$ and $c^2 = 1/(\mu_0\epsilon_0)$. Their contributions to intensity are therefore in the ratio 1:1. Chapter: Electromagnetic Waves.

169. A charged particle having drift velocity of 7.5×10^{-4} m s^{-1} in an electric field of 3×10^{-10} V m^{-1} has a mobility in $m^2 V^{-1} s^{-1}$ of

- (1) 2.5×10^6
- (2) 2.5×10^{-6}
- (3) 2.25×10^{-15}
- (4) 2.25×10^{15}

Answer (1)

Sol. Mobility μ is given by $\mu = \frac{v_d}{E}$, where v_d is the drift velocity and E is the electric field. Substituting the values, $\mu = \frac{7.5 \times 10^{-4}}{3 \times 10^{-10}} = 2.5 \times 10^6 m^2 V^{-1} s^{-1}$.
Chapter: Current Electricity.

170. A spherical conductor of radius 10 cm has a charge of 3.2×10^{-7} C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere? ($1/(4\pi\epsilon_0) = 9 \times 10^9$ N $m^2 C^{-2}$)

- (1) 1.28×10^5 N C^{-1}
- (2) 1.28×10^6 N C^{-1}
- (3) 1.28×10^7 N C^{-1}
- (4) 1.28×10^4 N C^{-1}

Answer (1)

Sol. The electric field outside a charged spherical conductor is given by $E = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$. Substituting the values, $E = 9 \times 10^9 \times \frac{3.2 \times 10^{-7}}{(0.15)^2} = 1.28 \times 10^5$ N/C.
Chapter: Electric Charges and Fields.

171. Taking into account of the significant figures, what is the value of 9.99 m - 0.0099 m?

- (1) 9.98 m
- (2) 9.980 m
- (3) 9.9 m
- (4) 9.9801 m

Answer (1)

Sol. Subtracting the values, 9.99 m - 0.0099 m = 9.9801 m. Considering significant figures, the result should be rounded to three significant figures, giving 9.98 m. Chapter: Units and Measurements.

172. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes :

- (1) half
- (2) four times
- (3) one-fourth
- (4) double

Answer (2)

Sol. The fringe width β is given by $\beta = \frac{\lambda D}{d}$, where λ is the wavelength, D is the distance to the screen, and d is the separation between the slits. If d is halved and D is doubled, β becomes $\beta' = \frac{\lambda(2D)}{\frac{d}{2}} = 4\beta$.

Therefore, the fringe width becomes four times.

Chapter: Wave Optics.

173. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is :

- (1) adiabatic
- (2) isochoric
- (3) isobaric
- (4) isothermal

Answer (1)

Sol. The system is thermally insulated, so $q = 0$; the gas expands freely against vacuum, so $w = 0$. This is an irreversible adiabatic free expansion (with $\Delta T = 0$ for an ideal gas). Chapter: Thermodynamics.

174. The energy equivalent of 0.5 g of a substance is

- (1) 4.5×10^{13} J
- (2) 1.5×10^{13} J
- (3) 0.5×10^{13} J
- (4) 4.5×10^{16} J

Answer (1)

Sol. $E = mc^2 = 0.5 \times 10^{-3} \times (3 \times 10^8)^2 = 4.5 \times 10^{13}$ J. Chapter: Nuclei.

175. A capillary tube of radius r is immersed in water and water rises in it to a height h . The mass of the water in the capillary is 5 g. Another capillary tube of radius $2r$ is immersed in water. The mass of water that will rise in this tube is :

- (1) 5.0 g (2) 10.0 g (3) 20.0 g (4) 2.5 g

Answer (2)

Sol. Capillary rise h is inversely proportional to r . The risen mass is $\rho\pi r^2 h$, so it is proportional to r . Doubling the radius therefore doubles 5 g to 10 g. Chapter: Mechanical Properties of Fluids.

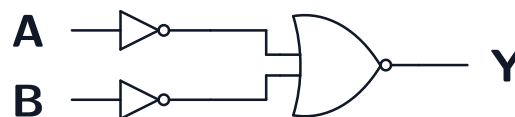
176. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is :

- (1) 0.25 mm (2) 0.5 mm (3) 1.0 mm (4) 0.01 mm

Answer (2)

Sol. The least count of a screw gauge is given by $LC = \frac{\text{pitch}}{\text{number of divisions}}$. Given $LC = 0.01$ mm and 50 divisions, $\text{pitch} = LC \times \text{number of divisions} = 0.01 \times 50 = 0.5$ mm. Chapter: Units and Measurements.

177. For the logic circuit shown, the truth table is



(1)

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

(2)

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

(3)

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

(4)

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

Answer (4)

Sol. Each input passes through a NOT gate, and the two inverted inputs feed a NOT-OR (NOR) gate, so $Y = \text{NOT}(\text{NOT } A \text{ OR } \text{NOT } B)$, which simplifies to $A \text{ AND } B$. The circuit is therefore an AND gate, whose output is high only when both inputs are high:

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

Chapter: Semiconductor Electronics.

Why the other options are wrong:

- (1) This is the OR truth table: it makes Y high whenever either input is high, which the inverters plus

NOR does not do.

- (2) This is the NOT-AND (NAND) truth table, the inverse of the correct one. It would follow from an AND gate with an inverted output.
- (3) This is the NOR truth table, which is what a single NOR gate gives for A and B directly, without the two inverters.

178. The average thermal energy for a mono-atomic gas is (k_B is Boltzmann constant and T , absolute temperature)

- (1) $(3/2)k_B T$ (2) $(5/2)k_B T$
 (3) $(7/2)k_B T$ (4) $(1/2)k_B T$

Answer (1)

Sol. The average thermal energy for a mono-atomic gas is given by $\frac{3}{2}k_B T$. This is derived from the equipartition theorem, which states that each degree of freedom contributes $\frac{1}{2}k_B T$ to the energy, and a mono-atomic gas has three translational degrees of freedom.
 Chapter: Kinetic Theory.

179. The solids which have the negative temperature coefficient of resistance are:

- (1) insulators only
 (2) semiconductors only
 (3) insulators and semiconductors
 (4) metals

Answer (3)

Sol. Metals have a positive temperature coefficient of resistance, while insulators and semiconductors have a negative temperature coefficient of resistance. This is due to the increase in carrier concentration in insulators and semiconductors with temperature.
 Chapter: Current Electricity.

180. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass. The centre of mass of the system from the 5 kg particle is nearly at a distance of :

- (1) 50 cm (2) 67 cm (3) 80 cm (4) 33 cm

Answer (2)

Sol. The center of mass x_{CM} is given by $x_{CM} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$. Substituting, $x_{CM} = \frac{5 \times 0 + 10 \times 100}{5 + 10} = \frac{1000}{15} \approx 67$ cm. Chapter: System of Particles and Rotational Motion.

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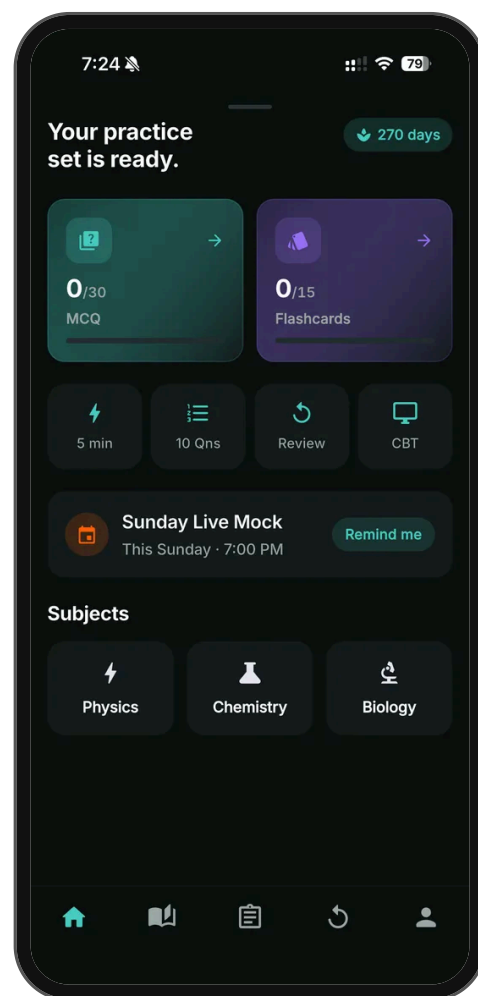
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