Biology

1. A.

Sol. ● The golgi apparatus (or dictyosome) is present in all eukaryotic cells.

● It is located near the nucleus.

● The two poles of a golgi apparatus are called cis face and trans face, which act respectively as the receiving and shipping departments.

● The vesicles lie near the ends and concave surface of the golgi complex.

● They are pinched off from the tubules of the cisternea of ER.

● They are of two types. Smooth or secretory vesicles, and coated vesicles, that have rough surface and elaborate membrane proteins. The golgi complex gives rise to primary lysosomes by budding from the trans face of cistrnae.

2. D.

Sol. Golgi apparatus is located near the nucleus.

3. C.

Sol. Centromere is a part of a chromosome that attaches to the spindle during cell division. The position of the centromere is a distinguishing feature of individual chromosomes. The centromere usually appears as a constriction when chromosomes contract during cell division.

4. D.

Sol. A lysosome is a tiny sac bounded by a single unit membrane of lipo protein discovered by De-Duve (1955). It contains a dense, finely granular fluid. The latter consists of glycoprotein hydrolytic (digestive) enzymes called acid hydrolases. These include proteases, lipases, nucleases, glycosidases, sulphatases, acid phosphatases, etc. However, all the enzymes do not occur in the same lysosomes. The lysosome enzymes can break down all the major biological marcromolecules present in the cells or entering the cells from outside into their building block subunits by addition of water, So, these are digestive in nature. The lysosome enzymes are active in acid medium, at about pH 5, hence their name, It is also called suicidal bag.

5. B.

Sol. In desmosomes circular patches of cell membranes are held together by interaction of proteins that extend through each membrane into the space between cells. The cell membrane has on the inner side a dense plate of protein for mechanical support and bears fine filaments, the tonofibrils, radiating into the cell. The desmosomes act as “spot welds” and keep the cells firmly together.

6. A.

Sol. Prokaryotic flagellum is not surrounded by any membrane. It consists of a single thread. The thread is made of numerous identical spherical protin sub-units called, flagellin. Each subunit is about 40Å in diameter. The flagellin sub-units are arranged in helical spirals and form a hollow cylinder. Each flagellum is about 120-150 Å thick.

7. B.

Sol. ***Refer answer 4***

8. D.

Sol. Protein synthesis in an animal cell, takes place in the nucleolus as well as in the cytoplasm. Main part of protein synthesis (transcription and translation) occurs in nucleolus. Chain elongation occurs in cytoplasm.

9. A.

Sol. Ribosomes are naked ribonule-oprotien protoplasmic particles which function as the site for protein synthesis. Therefore they are popularly known as protein factories. Ribosomes are produced in nucleolus and occur on nuclear membrane & RER. It is also present in cytoplasm in proka-ryotes and eukaryotes. Chemically ribosomes, is made up of rRNA and protein. As ribosomes, nucleolus and centrioles are also membraneless cell organelles. Usually more rRNA is present in 70S ribosomes as compared to protein (60-65. 35-40) while the reverse is true for 80S ribosomes (40-44. 56-60)

10. A.

Sol. Middle lamella is the first formed layer, present between the two adjacent cells. It is situated outside the primary cell wall. It is made up of calcium and magnesium pectate.

11. C.

Sol. A chloroplast is a vesicle bounded by an envelope of two unit membranes and filled with a fluid matrix called stroma. The lamellae, after separation from the inner membrane, usually take the form of closed, flattened, ovoid sacs, the thylakoids, which lie closely packed in piles, the grana. The thylakoid membrane contains photosynthetic pigments namely, chlorophyll a, chlorophyll b, carotenoids (carotene, xanthoph-ylls) and plastoquinone. The thyl-akoid membranes also contain coupling factors that bring about ATP synthesis.

12.D.

Sol. The proteins formed on ribosomes pass into the ER lumen where they are modified. Then the modified proteins move on into the transitional area, where the ER buds off membranous sacs, the transport vesicles, carrying the proteins to the Golgi apparatus. Here, they are further processed and packaged into secretory vesicles for export by exocytosis at the plasma membrane. Chloroplasts are specialized to perform photosynthesis. Mitochondria is the power house of the cell. Lysosomes contain hydrolytic enzymes.

13. B.

Sol. Cilia are fine hair vibratile, cytoplasmic processes borne by certain cell types. Their movment either propel the organism or move the medium past a fixed cell. The cilia are enclosed by a unit membrane which is an extension of the plasma membrane of the cell. Within the membrane, is a fluid matrix having a supporting axial shaft, or axoneme. The axoneme is composed of eleven microtubules. Two microtubules are single and lie at the centre with a gap in between. They are called central singlets. The remaining nine microtubules are double and lie in a ring around the central microtubules. The two microtubules are single and lie at the centre with a gap in between. They are called central singlets. The remaining nine microtubules are double and lie in a ring around the central microtubules. The two microtubules forming a doublet are named A and B subtubules. The microtubules, single as well as double, are composed of the globular units of the protein tubulin. The arms of A microtubules contain a protein dynein. The latter is ATPase enzyme which catalyzes hydrolysis of ATP to ADP, and transfers the free energy released direct to ciliary work.

14. A.

Sol. Both chloroplasts and mitochondria contain DNA and are double membrane bound organelles having an inner membrane and outer membrane. Mitochondria occur in cytoplasm of both plants and animal cells. A mitochondria contains two chambers. The inner membrane forms mitochondrial cristae, Chloroplast is also a double membranous organelle but found only in plants. The membrane bound matrix of chloroplasts is stroma and inside the stroma thylakoids are present which form grana.

15. D.

Sol. Endoplasmic reticulum functions as cytoskeleton or intracellular and ultrastuctual skeletal framework by providing mechanical support to colloidal cytoplasmic matrix. Proteins and enzymes synthesised by ribosomes enter the channels of rough endoplasmic reticulum both for intracellular uses as well as extracellular transport.

16. B.

Sol. The gametophytic generation represents the dominant phase in the life cycle of bryophytes. The sporophytic phase is dependent on the gametophyte. That is why, the plant body of Funaria is predominantly gametophytic generation with sporophyte.

17. A.

Sol. Tallest tree (gymnosperm)-Sequoia sempervirens. Largest ovule and largest gametes belong to Cycas (a gaymnosperm).

18. A.

Sol. In fern diploid spore mother cells present in sporangia divide meiotically to form haploid spores. After maturation, spores falls on suitable medium and germinate to form a flat cordate green thalloid gametophyte called prothallus.

19. B.

Sol. The algal class rhodophyceae contains a red pigment (r-phycoerythrin) and a blue pigment (r-phycocyanin) is the chromatophores. These pigments can utilize those wavelengths. These pigments can utilize those wavelength of light (blue-green region of spectrum, i.e., 480-520 mm) that are not absorbed by chlorophyll. This enables red algae to grow at greate depths than other plants (upto 300 ft. below water). In addition to these, chl a, chl d, carotenes and xanthophylls are present. In phaeophyceae chromatophores are yellowish brown in colour possessing xanthophylls in abundance. Bacillariophyceae are called diatoms due to presence of an accessory brown pigment called diatomin, other pigments are chl a, chl c (but not chl b), carotenes and xanthophylls. In chlorophyceae colouring pigments are just like higher plants, i.e., chl a, chl b, xanthophylls and carotenes.

20. A.

Sol. Cycas falls under sub division gymnospermae because it has naked seeds or ovules. Angiosperm is the sub division of those plants which has covered seed, show double fertilization and have triploid endosperm. All these features are absent in Cycas.

21. D.

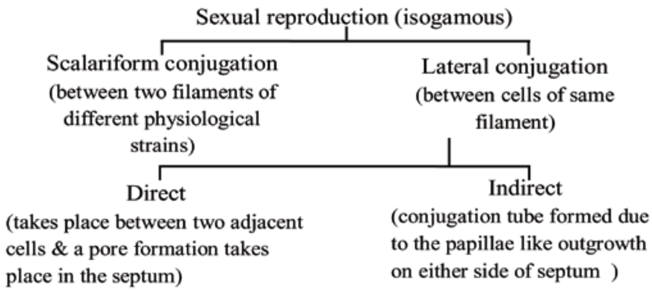
Sol. Pinus belong to order coniferales of gymnosperms. The plant is differentiated into root, stem and leaves. Flowers are absent but seeds are present. Plants are monoecious. It develops clusters of shortly stalked male cones subterminally on the lower branches and female cones in circle of 2-6 on upper long branches. A male cone has a central axis and a number of spirally arranged microsporohylls. A microsporophyll bears two oblong microsporangia abaxially on the proximal part. The terminal flattened part is bent and sterile. A microsporangium produces a large number of yellow pollen grains. Each pollen grain has two wings or air sacs for floating in the air. The central axis of female cone bears paired scales. In each pair the lower scale is bract scale while the upper one is ovuliferous scale (= megasporophyll complex). The terminal sterile part of ovuliferous scale is broad and called apophysis. The proximal adaxial side bears two ovules.

22. B.

Sol. In angiosperms presence of vessels is not an universal feature as there are certain angiosperms where vessesl are absent e.g., Wintera, Trochodendron etc. Secondary growth is increase in the girth or diameter of axis (root and stem) of the plant by formation of secondary tissues by the activity of lateral meristem. It occurs in dicotyledons of angiosperms and gymnosperms. But in monocotyledons of angiosperms the primary plant body is complete in itself and doesn't produce any secondary tissue. Autotrophic plants are those which synthesise their organic food themselves by the process of photosynthesis. But certain angiospermic plants have heterophic mode of nutrition. e.g., Rafflesia, Orobanche, Striga are root parasites. But double fertilization is universal in all angiosperms. It involves fusion of one male gamete with the egg cell and another male gamete with the diploid secondary nuclei.

23. D.

Sol. The sexual reproduction of Spirogyra is called conjugation, it involves the fusion of two morphologically identical, but physiologically dissimilar gametes. It is of two types as shown in the following chart.

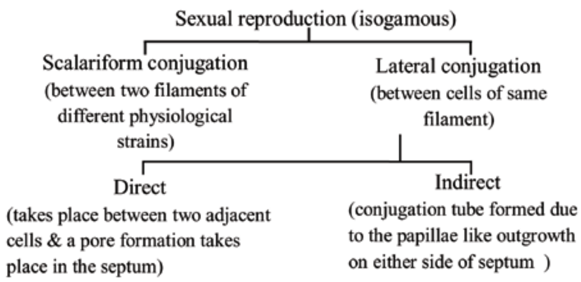


24. A.

Sol. Seed producing plants are called spermatophyta (gymnosperms and angiosperms). Fern belongs to the division pteridophyta and Funaria is a member of division bryophyte. Hence these two represent the pair which are not seed producing. Ficus is an angiosperm and Pinus is a gymnosperm. Both are seed producing plants.

25. D.

Sol. Spermatophyta includes seed bearing plants and this includes gymnosperms and angiosperms. Acacia and sugarcane both are angiosperms. Pinus and Cycas both are



gymnosperms.Rhizopus belongs to kingdom fungi and Triticum is an angiosperm. Ginkgo is gymnosperm and Pisum is an angiosperm. So Ginkgo and PIsum correctly represent the grouping spermatophyta.

26. A.

Sol. Eichler divided plant kingdom into two sub-kingdoms-cryptogamae and phanerogamae. All plants without flowers and seeds are included in the sub-kingdom cryptogamae whereas phanerogamae includes plants which bear flowers and seeds. Cryptogams are further classified into three divisions-thallophyta, bryophyte and pteriodphyta. Spore bearing plants such as mosses and ferns belong to cryptogams because instead of reproducing by flowers and seeds they reproduce by means of spores.

27. A.

Sol. Angiosperms are highly evolved and well adapted land plants. They have both vessels and tracheids in xylem for better conduction of water. Roots are modified into tap roots, adventitious roots, pneumatophores etc. to suit the desired climate. Sex organs are highly developed, sporophylls are organized into flowers and the flowers are highly coloured or modified to attract pollinators at different times and places insect pollination is more prevalent because it is more efficient and leads to less wastage of pollen grains as compared to wind pollination. So the flowers are made attractive to attract a variety of insects. Seed are more producted as they are enclosed inside a fruit. All these adaptations have made angiosperms more adaptive in diverse habitats.

28. A.

Sol. Diversification in plant life appeared due to long periods of evolutionary changes. Algae and bryophytes have thalloid plant body with no differentiation into root, stem and leaves. They had no vascular tissues but later in pteridophytes vascular tissues (xylem and phloem) developed and plant body became differentiated into root, stem and leaves. But the vascular tissues lack vessels and companion cells and they reproduce by spores. In gymnosperms seed habit developed but the seeds are not enclosed inside fruit in angiosperms vessels and companion cells are present, flowers are present and seeds are enclosed inside fruits. Thus the path of evolution is from algae to bryophytes to pteridophytes to pteridophytes to gymnosperms and finally to angiosperms.

29. A.

Sol. Cycas is an evergreen palm like plant. It belongs to order cycadales of gymnosperms. The plant body is sporophytic differentiated into root, stem and leaves, sexual reproduction is of oogamous type takes place by the fusion of distinct male and female gametes. The male and female gametes are formed by the germination of microspores and megaspores which are borne on microsporophylls and megasporophylls. These microspores geminate to form male gametophyte that produces male gametes. The male gametes of Cycas are largest (300 μm) in nature, visible to naked eye, oval in form and top shaped. Male gamete is spirally coiled in the anterior half with throusands of small cilia. After fertilization the ovule is converted into a seed. In the endosperm of seed lies a well developed embryo having two cotyledons, a plumule and a radicle.

30. A.

Sol. Flagellation is the arrangement of flagella over the body surface of a bacterial cell. Peritricchous flagellation has flagella all over the surface of a bacterial cell e.g., E. Coli. Ginkgo belongs to order ginkgoales of gymnosperms. It is called living fossil because it is the single living genus in a big fossilzed order. Rhizophore is a leafless, colourelss, positively geotropic elongated structure that grows down from the point of bifurcation of stem. It occurs in Selaginella. Macrocystis belongs to class phaeophyceae. It is the largest perennial alga, about 40-60 m in size. Wolffia is the smallest flowering plant.

31. A.

Sol. Stele is a column containing vascular tissues which is surrounded by pericycle and separated from ground tissue by endodermis.

Siphonostele is medullated protos-tele or protostele with a central non-vscular pith. Leaf gaps are absent. Siphonostele is of two types. In ectophloic siphonostele, central pith is surrounded successively by xylem, phloem, pericycle and endodermis. In amphiphloic siphonostele there is a central pith and xylem is surrroudned on either side by phloem, pericycle and endodermis. It is found in Osmunda and Equisetum.

32. B.

Sol. Mosses are bryophytes, or non-vascular plants. Aside from lacking a vascular system, they have a gametophyte-dominant life cycle, i.e., the plant cells are haploid for most of its life cycle. Sporophytes (i.e. the diploid body) are short-lived and dependent on the gametophyte.

33. C.

Sol. The partially decomposed Sphagnum mass accumulates to form compressed mass called peat, which after drying is used as coal. So it is also called peat moss. Sphagnum has the capacity to retain water for long periods as it is hygroscopic and thus it is used to cover plant roots during transportation.

34. B.

Sol. Gymnosperms lack double fertilization. They have haploid (n) endosperm. If a gymnospermic leaf have 16 chromosomes (2n), the number of chromosomes in its endosperm will be 8. The endosperm in gymnosperms is prefertilisation tissue and is equivalent to female gametophyte and thus haploid in nature but in angiosperms, it is post fertilisation tissue and is generally triploid in nature.

35. C.

Sol. In prothallus of vascular cryptogams the antherozoids and eggs mature at different times. The spores on germination gives rise to prothallus. The antherrozoids are biflagellated or multiflagellated. The antherozoids are biflagellated or multiflagellated. The egg is produced inside the ventre, water is essential for fertilization and it is always cross-fertilization. Self fertilization is prevented.

36. D.

Sol. Algae are a group of chlorophyllous, nonvascular plants with thallose plant body. Different algae show different pigments present in the cell like chlorophyll a, b, xanthophylls, carotenes etc. These pigments provide the base for classification of various groups of algae into different classes. Chlorophyceae possess chlorophyll a, b, pigments. bacillariophyceae contains diatomin pigment, phaeophyceae has fucoxanthin, rhodophyceae has r-phycocyanin and r-phycoerythrin, cyanophyceae has phycobilin pigment.

37. C.

Sol. Flagellated male gametes are mostly seen lower groups of plants like alge, bryophytes, pteriodphytes. It is also seen in certain gymnosperms like Cycas. The bryophytes like Riccia have the male gametes which are biflagellate.

38. D.

Sol. An elater is a cell (or structure attached to a cell) that is hygroscopic, and therefore will change shape in response to changes in moisture in the environment. Elaters come in a variety of forms, but are always associated with plant spores. In plants that do not have seeds, they function in dispersing the spores to a new location. In the liverworts, elaters are cells that develop in the sporophyte alongside the spores. They are complete cells, usually with helical thickenings at maturity that respond to moisture content. In most liverworts, the elaters are unattached, but in some leafy species (such as Frullania) a few elaters will remain attached to the inside of the sporangium (spore capsule). The elaters by hygroscopic movement help in spore dispersal.

39. C.

Sol. In gymnosperms pollen chamber represents the microsporangium in which pollen grains develop. The microspore is generally a globular sac like structure having large number of microspores. The microspores are also termed as pollen grains.

40. B.

Sol. In gymnosperm (like Cedrus) the male and female gametophyte do not have an independent free living existence. They remain within the sporangia retained on the sporopytes i.e., female gametophyte with megasporangium and male gametophyte within microsporangium. In bryophytes like Polytrichum and Funaria, the main plnat body is a gametophyte which is independent and the sporophyte is partially or fully dependent on gametophytic generation. In pteridophytes (pteris) gametophyte is usually independent and sporophyte is the dominant phase in the life cycle.

41. B.

Sol. In some xerophytic species of Selaginella such as S. lepidophylla and S. pipifera, the plant during the dry periods assumes a shape of a tight ball which in the presence of water opens up into normal green plant. Such plants are commonly known as the "resurrection plants" and are later sold as novelties.

42. D.

Sol. Volvox is a colonial green alga. The cells are definitely organised and hence the plant body is called coenobium. The coenobium of Volvox are the largest, highly differentiated and well evolved among motile forms.

43. D.

Sol. In Marchantia, elater mother cells give rise to elaters which help in scattering the spores differentiated from the spore mother cells. In Riccia, and Funaria elaters are not found.

44. D.

Sol. Megasporophyll of Cycas are born on female plant which produces ovule. Carpel is also a female reproductive organ of flowering plant. So both are of same nature. (i.e. female sex organ).

45. D.

Sol. The gametophytic generation represents the dominant phase in the life cycle of bryophytes. The sporophytic phase is dependent on the gametophyte. That is why, the plant body of Funaria is predominantly gametophytic generation with sporophyte.

46. C.

Sol. Maximum solar energy is trapped by algae and hence they evolve maximum amount of oxygen by the process of photosynthesis. Therefore algae are useful because they purify the atmosphere by releasing oxygen.

47. C.

Sol. In Ulothrix sexual reproduction is of isogamous type. Two isogametes of + and – strain come together and fuse as a result a quadrifagellate zygospore is formed which floats on water after sometime it rests on the bottom of the pond at this time its four flagella disintegrate and a wall is formed surrounding it from all sides. After taking rest for a long period this zygote divides meiotically and gives rise to 16 zoospores. These zoospores come out of sac and give rise to the new plants of Ulothrix.

48. A.

Sol. Bryophytes cannot complete their life-cycle on land without water, as water is necessary for act of fertilization, i.e. biflagellated antherozoids swim across the film of water.

49. D.

Sol. Unlike Cycas and Pinus, Gnetum shows the occurrence of vessel elements and the absence of archegonia. In Gnetum archegonia are altogether absent in the female gametophyte and vessels occur in the xylem along with the tracheids in the secondary wood. Thus Gnetum shows affinities with angiosperms. Besides it resembles angiosperms in several other aspects like presence of tetrasporic embryo sac, free nuclear divisions in the embryosac, two cotyledonous smbryo etc.

50. A.

Sol. ***Refer answer*** **31.**

51. B.

Sol: For the digestion of proteins and polypeptides into constituent amino-acids.

52. B.

Sol: Since it is broadly sharp at edges. which is required for biting.

53. C.

Sol: As it comes at last in an individual's life, almost after attaining maturity (wisdom).

54. B.

Sol: Casimir Funck (1912).

55. D.

Sol: Kwashiokar is a protein deficiency disease and Rickets is a Vit-D deficiency disease.

56. A.

Sol: Also known as Parietal cells – These are large and most numerous on the side walls of the gastric glands. They secrete HCl, pepsinogen and soluble mucin, – acidic secretion.

57. A.

Sol: Bile salts help in the digestion of fats in the small intestine by bringing about their emulsification (conversion of large fat droplets into small ones).

58. A.

Sol: Rumination is the process in which mammals like buffaloes, cattle etc. chew partially digested food called-cud. Therefore the animals performing the act of Rumination are called as Ruminants.

59. A.

Sol: It is a mineral-deficiency disease caused due to deficiency of Iodine. In this disease, there occurs enlargement of thyroid gland.

60. A.

Sol: Laecum is that part of large intestine where certain bacteria (symbiotic bacteria) inhabit and help in the digestion of cellulose. Since cellulose is not a main part of our food, so caeum is vestigial in humans.

61. A.

Sol: CO binds with haemoglobin at the same place (heme group) where O_2 binds, but about 250 times more readily than O_2. Hence it easily displaces O_2 from haemoglobin and even a concentration of about 0.1% in alveolar air is enough to occupy about half of haemoglobin of pulmonary blood, rendering it useless for O_2 transport.

62. A.

Sol: The value of R depends on the type of "fuel substance" being utilized for energy production. For instance, when mainly the carbohydrates are utilized for energy production, the value of R rises to 1.00, because one molecule of CO_2 is formed for each molecule of O_2 consumed.

$$C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O$$

$$\therefore\ R = \frac{CO_2}{O_2} = \frac{6}{6} = 1.00$$

63. D.

Sol: About 23% of CO_2 entering into blood from tissues fluid reversibly binds with the globin portion of haemoglobin, forming carbamino haemoglobin.

$$CO_2 + Hb \rightleftharpoons Hb \cdot CO_2$$

(carbomino haemoglobin).

64. B.

Sol: Most of the CO_2 entering into the blood plasma reacts with water, forming carbonic-acid-

$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

(carbonic acid)

This reaction is very slow in plasma, but occurs very rapidly inside RBCs, because an enzyme carbonic anhydrates present in RBCs accelerates its rate about 5000 times. That is why, about 70% of the CO_2 received by blood from the tissues immediately enters into RBCs and is hydrated to carbonic acid.

65. C.

Sol: The gaseous exchange between cells and blood of tissues capillaries through tissue fluid occurs by simple diffusion (passive) and depends on partial pressures of O_2 and CO_2 in the blood and cells.

66. C.

Sol: Occupational lung disease.

67. A.

Sol: At high altitude, the composition of air remains almost same as at sea-level, but density of air gradually decreases. No. of RBCs per unit volume of blood is likely to be higher in a person living at high altitudes because air is less dense. At high altitude, O_2 level less, hence more RBCs are required to absorb enough oxygen.

68. B.

Sol: Increased temperature decreases O_2 affinity of haemoglobin which therefore release more O_2 in the tissues to fulfill the increased demand of cells. As a result the O_2-haemoglobin dissociation curve shifts to the right.

69. B.

Sol: CO_2 lowers the oxygen-affinity of haemoglobin even if the pH is kept constant (Bohr effect). Oxygen dissociation curve shifts to the right and releases, more O_2 with increase in PCO_2.

70. C.

Sol: Myocardial infarction is due to the formation of a stationary blood-clot (Thrombus) or cholesterol plaques (atherosclerosis) in coronary arteries. Injections of clot-dissolving and blood-thinning agents such as streptokinase, tissue plasminogen, urokinase etc. administered with heparin are used to dissolve the blood clots and plaques.

71. B

Sol: Lubb sound is a low-pitched sound produced by blood turbulence when AV valves close at the beginning of ventricular systole.

72. A.

Sol: Adrenaline hormone is secreted by medulla of the adrenal glands. It accelerates the heart beat under emergency conditions like fear, fight etc. this hormone directly influence the SA node.

73. A.

Sol: Arteriosclerosis is the hardening of the arteries due to the deposition of precipitate of calcium salts and cholesterol. Such artery loses the property of distention and its wall may rupture resulting in the formation of clot or thrombosis in the coronary artery leading to heart attack and even death.

74. B.

Sol: Mycocardial infarction, popularly referred to as heart attack, is a very serious, often fatal heart disease. It often results from a sudden decrease in coronary blood supply. In this event, a portion of cardiac muscles stops working because it no longer receives oxygen and dies within few minutes.

75. C.

Sol: Each cardiac cycle is consists of one heart beat or one cycle of contraction and relaxation of the cardiac muscles. The contraction phase is called the systole while the relaxation phase is called the diastole. Each cardiac cycle takes 0.8 seconds to complete.

76. B.

Sol: Oxytocin stimulates contraction of uterine muscles, inducing labour pains for child birth when secretion of progesterone hormone from the placenta declines, marking the end of pregnancy.

77. C.

Sol: Adrenaline hormone directly influence SA node, thereby altering both heart rate and stroke volume.

78. B.

Sol: Basophiles are fairly large and have nearly S-shaped nucleus and few coarse granules. Which contain histamine. The basophiles release histamine & heparin by exocytosis into the blood.

79. C.

Sol: The worn-out RBC are phagocytized by the free and fixed macrophages present in the spleen. For this reason, spleen is often described as the "graveyard" or "slaughter house" of the worn-our erythrocytes.

80. D.

Sol: Some animals including primates-man excrete some amount of uric-acid which is formed in their body due purine metabolism (adenine and guanine).

81. A.

Sol: P-wave represents atrial depolarization which spreads from SA node to atrial myocardium.

82. C.

83. B.

Sol: The cells lining the PCT are well adapted for reabsorption of materials from the glomerular filterate. They have abundant mitochondria and bears numerous microvilli on the free side. Mitochondria power the active transport of nutrient molecules back into the blood. Microvilli increases the surface area for reabsorption.

84. D.

Sol: Glomerular filterate or ultra-filterate formed during the process of ultra-filteration, contains molecules smaller than 3nm like water, electrolytes, glucose, aminoacids, nitrogenous wastes etc. leaving behind large molecules like globulin, blood corpuscles etc, in the blood (efferent arteriole)

85. A.

Sol: Ketouria is the presence of ketone bodies in urine, due to metabolism of fatly acids instead of glucose during diabetes, starvation and pregnancy.

86. B.

Sol: Stenohaline animals live within a narrow range of salinity.

87. D.

Sol: Loop of henle is a U-shaped segment of the nephron located in the renal medulla. Its primary role is to concentrate the salt in the tissue surrounding the loop.

88. D.

Sol: Alkaptonuria is an inherited metabolic disorder produced due to deficiency of an oxidase enzyme required for breakdown of homogentisic acid (also called alcapton). Lack of the enzyme is due to absence of the normal form of gene that controls the synthesis of this enzyme. Hence, homogentisic acid then accumulates in the tissues and is also excreted in the urine.

89. A.

Sol: Metanephric kidney or metanephros are most advanced kidney in which loop of Henle is present. Also called as posterior kidney. It is functional in reptiles, birds & mammals.

90. A.

Sol: GFR is auto-regulated by juxtaglomerular apparatus which modulates blood pressure and thus renal blood flow by releasing Renin. Renin actually activate the renin-angiotensin aldosterone pathway (RAAS).

Physics

1.(D)

Sol. Required error is 2 × 2% + 1% + 1%, i.e., 6%

2.(B)

Sol. $V=\frac{\pi}{8}\frac{Pr^4}{nl}=\frac{ML^{-1}T^{-2}L^4}{ML^{-1}T^{-1}L}=M^0L^3T^{-1}$

3.(D)

Sol. $m \propto v^a \rho^p g^c$

$ML^0T^0 \propto (LT^{-1})^a\ (ML^{-3})^b\ (LT^{-2})^c$

Comparing the powers of M, L, and solving, we get b = 1, c = –3, a = 6 ⇒ m, ∝ v^6

4.(A)

Sol. Area from 0 to 10 s $=\frac{1}{2}[10+4]5=35$ m

Area from 10 to 12 s $=\frac{1}{2}\times 2\times(-2.5)=-2.5$ m

Distance travelled = 35 + 2.5 = 37.5 m

5.(B)

Sol. Suppose v be the velocity attained by the body after time t_1.

Then $v = u - gt_1$ (i)

Then the body reach the same point at time t_2. Now velocity will be downwards with same magnitude v. Then

$-v = u - gt_2$ (ii)

(i) – (ii) ⇒ $2v = g(t_2 - t_1)$

or $t_2-t_1=\frac{2v}{g}=\frac{2}{g}(u-gt_1)=2\left(\frac{u}{g}-t_1\right)$

6.(A)

Sol. $t=\sqrt{x}+3,$

Differentiating with respect to t, we get

$1=\frac{1}{2\sqrt{x}}\frac{dx}{dt}+0$ or $\frac{dx}{dt}=2\sqrt{x}$

When velocity is zero, $2\sqrt{x}=0$ or $x=0$.

7.(A)

Sol. Time to reach the maximum height, $t_1=\frac{u}{g}$

If t_2 be the time to hit the ground, then $-H=ut_2-\frac{1}{2}gt_2^2$

But $t_2 = nt_1$ (given)

$\Rightarrow -H=u\frac{nu}{g}-\frac{1}{2}g\frac{n^2u^2}{g}$

⇒ $2gH = nu^2(n - 2)$

8.(C)

Sol. $a_c=\frac{v^2}{r}\rightarrow$ Constant in magnitude if v is constant.

9.(B)

Sol. Given $y=12x-\frac{3}{4}x^2, u_x=3\text{ ms}^{-1}$

$v_y=\frac{dy}{dt}=12\frac{dx}{dt}-\frac{3}{2}\times\frac{dx}{dt}$

At $x=0, v_y=u_y=12\frac{dx}{dt}=12u_x=12\times 3=36\text{ ms}^{-1}$

$a_y=\frac{d}{dt}\left(\frac{dy}{dt}\right)=12\frac{d^2x}{dt}-\frac{3}{2}\left[\left(\frac{dx}{dt}\right)^2+x\frac{d^2x}{dt^2}\right]$

But $\frac{d^2x}{dt^2}=a_x=0.$ Hence

$a_y=-\frac{3}{2}\left(\frac{dx}{dt}\right)^2=-\frac{3}{2}u^2x=-\frac{3}{2}\times(3)^2=-\frac{27}{2}\text{ ms}^{-2}$

Range, $R=\frac{2u_xu_y}{a_y}=\frac{2\times 3\times 36}{27/2}=16\text{ m}$

10.(C)

Sol. Here thrust on the rocket is

$F = m(g + a) = 3.5 \times 10^4(10 + 10)$

$= 7.0 \times 10^5$ N

11.(C)

Sol. From 0 to 2 s: at any time t, $F = 10\,t$

$\Rightarrow a = F/m = 10\,t/m$

$$\Rightarrow \int_0^v dv = \int_0^t \frac{10t}{m}\,dt \quad \Rightarrow v = \frac{5t^2}{m}$$

Momentum: $P = mv = 5t^2$

At $t = 2$ s, $P = 5(2)^2 = 10$ kg ms^{-1}, $v = 20/m$

From 2 to 4 s: $F = 40 - 10\,t$

$$\int_{20/m}^{v} dv = \int_2^1 \frac{40-10t}{m}\,dt$$

$$\Rightarrow v = \frac{1}{m}[40t - 40 - 5t^2]$$

$$P = mv = 40t - 40 - 5t^2$$

12.(A)

Sol. Acceleration of the skaters will be the ratio

$$\frac{F}{4} : \frac{F}{5} \text{ or } 5:4$$

Now according to the problem,

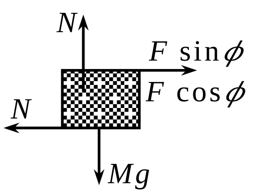
$s = 0 + \frac{1}{2}at^2$, we get

$$\frac{s_1}{s_2} = \frac{a_1}{a_2} = \frac{5}{4}$$

13.(C)

Sol. $N = Mg - F\sin\phi$

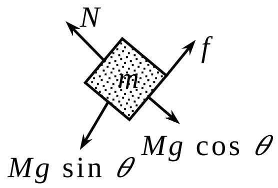
From Figure.



$$a = \frac{F\cos\phi - \mu(Mg - F\sin\phi)}{M}$$

14.(A)

Sol. $N\ mg\cos\theta$, $f = mg\sin\theta$



Net force applied by M on m (or m on M) :

$$F = \sqrt{N^2 + f^2}$$

$$= \sqrt{(mg\cos\theta)^2 + (mg\sin\theta)^2}$$

$= mg$

15.(C)

Sol. $f = mg\sin\theta \Rightarrow 10 = m \times \sin 30°$

$\Rightarrow m = 2$ kg

16.(A)

Sol. KE of blocks at B = PE at A – PE at B

$$\frac{1}{2}mv^2 = mgh - mg(h - 2r)$$

$v^2 = 2g(h - 2r)$ (i)

Also, $\frac{mv^2}{r} = x\,mg + mg$

or $v^2 = (x + 1)rg$ (ii)

Equating Eqs (i) and (ii), we get $2g(h - 2r) = (x + 1)gr$

or $2gh = (x + 1)gr + 4gr = (x + 5)gr$

$$h = \left(\frac{x+5}{2}\right)r$$

17.(C)

Sol. The work done by the man negative of the magnitude of decrease in potential energy of the chain.

$$\Delta U = mg\frac{l}{2} - \frac{m}{2}g\frac{l}{4} = 3\,mg\frac{l}{g}$$

$$W = -\frac{3mgl}{g}$$

18.(B)

Sol. We known that $dU = -dW$

when dU is the change in potential energy and dW is the work done by conservative forces

Hence, work done by conservative forces on a system is equal to the negative of the change in potential energy.

19.(C)

Sol. Let the mass of each body be m. Their motion is represented as shown in the figure.

From $\vec{V}_{CM} = \dfrac{m_1\vec{V}_1 + m_2\vec{V}_2}{m_1 + m_2}$

$$v_{CM} = \frac{m \times 2v - mv}{m + m}$$

[The direction of motion of the first particle is taken as positive.] So the velocity of the centre of mass of the system is $v/2$ in the direction of motion of the particle having larger speed.

20.(D)

Sol. As no external force acts, so centre of mass remains at rest.

21.(A)

Sol. In this problem the velocity of the earth before and after the collision may be assumrd zero. Hence, coefficient restitution will be

$$e^n = \frac{v_1}{v_0} \times \frac{v_2}{v_1} \times \frac{v_3}{v_2} \times \cdots \times \frac{v_n}{v_n - 1}$$

where v_n is the velocity after nth rebounding and v_0 is the velocity with which the ball strikes the earth for the first time.

Hence,

$$e^n = \frac{v_n}{v_0} = \frac{\sqrt{2gh_n}}{\sqrt{2gh_0}}$$

where h_n is the height to which the ball rises after nth rebounding. Hence,

$$e^n = \frac{v_n}{v_0} = \frac{\sqrt{h_n}}{\sqrt{h_0}}$$

22.(A)

Sol. F wil provide anticlockwise torque about the centre due to which the bottommost point will tend to move towords right, so friction will act towards left. So it will move towards left.

23.(D)

Sol. In case of rolling in the inclined plane, friction is static and acts in the upward direction and is given by

$$f = \frac{mg\sin\theta}{1 + \dfrac{R^2}{k^2}}$$

For sphere, $k^2 = \dfrac{2}{5}R^2$

From Eqn. (i) and (ii),

$$f = \frac{2}{7}mg\sin\theta \text{ (upwards)}$$

24.(C)

Sol. The distribution of mass is nearest about *xx*.

25.(B)

Sol. $V = V_1 - V_2$

$$V_1 = -\frac{GM}{2R^3}\left[3R^2 - \left(\frac{R}{2}\right)^2\right]$$

$$V_2 = -\frac{3G\left(\frac{M}{8}\right)}{2\left(\frac{R}{2}\right)}$$

$$\Rightarrow \quad V = \frac{-GM}{R}$$

26.(B)

Sol. Applying conservation of angular momentum at position *A* and *B*

$$mv_A \times OA = mv_B \times OB$$

Hence, $\frac{v_B}{v_A} = \frac{OA}{OB} = x$

27.(D)

Sol. $\vec{F} = \vec{F}_1 + \vec{F}_2$

As $|\vec{F}_1| = |\vec{F}_2|$

$\therefore \quad |\vec{F}| = 2\vec{F}_1 \cos 30^\circ$

$$= 2\frac{GM^2}{(2r)^2}\frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}\frac{GM^2}{r^2}$$

28.(A)

Sol. $B = \frac{\Delta p}{\Delta V/V} = \frac{h\rho g}{0.1/100} = \frac{200\times10^3\times9.8}{1/1000}$

$= 19.6 \times 10^8$ N/m^2

29.(A)

Sol. $l \propto \frac{1}{Y} \Rightarrow \frac{Y_s}{Y_c} = \frac{l_c}{l_s} \Rightarrow \frac{l_c}{l_s}$

$$= \frac{2\times10^{11}}{1.2\times10^{11}} = \frac{5}{3} \qquad \text{...(i)}$$

Also $l_c - l_s = 0.5$ ...(ii)

On solving (i) and (ii), we get

$l_c = 1.25$ cm and $l_s = 0.75$ cm

30.(C)

Sol. Work done in stretching a wire

$$W = \frac{1}{2}Fl = \frac{1}{2}\times10\times0.5\times10^{-3} = 2.5\times10^{-3} J$$

Work done to displace it through 1.5 mm

$W = F \times l = 5 \times 10^{-3}$ J

The ratio of above two work = 1:2

31.(B)

Sol. Let *v* be the volume of the solid block of density ρ. Let ρ_1 be the density of water. Weight of body $= v\rho g$. When the body is immersed in water.

Tension in the string = Upward thrust – Weight of the body

$\Longrightarrow T = v\rho_1 g - v\rho g = vg(\rho_1 - \rho_2)$

When the lift is moving upwards with acceleration a, the tension in the string is $T = v(\rho_1 - \rho)(g + a)$

From Eqs. (i) and (ii),

$T = T_0(1 + a/g)$

32.(C)

Sol. Let d_w and d_0 be the densities of water and oil, respectively.

Then the pressure at the bottom of the tank is $h_w d_w g + h_0 d_0 g$.

Let this pressure be equivalent to pressure due to water of height *h*. Then,

$$hd_w g = h_w d_w g + h_0 d_0 g$$

$$\therefore \qquad h = h_w + \frac{h_0 d_0}{d_w} = 100 + \frac{400\times0.9}{1}$$

$= 100 + 360 = 460 = 4.6$ m

According to Toricelli's theorem,

$$v = \sqrt{2gh} = \sqrt{2\times10\times4.6}\ \text{m/s}$$

$$= \sqrt{92}\ \text{m/s}$$

33.(C)

Sol. $\rho 4\pi R^2 \Delta RL = T4\pi[R^2 - (R - \Delta R)^2]$

$\rho R^2 \Delta RL = T[R^2 - R^2 + 2R\Delta R - \Delta R^2]$

$\rho R^2 \Delta RL = T2R\Delta R$ (ΔR is very small)

$$R = \frac{2T}{\rho L}$$

34.(D)

Sol. Total energy emitted by the sum per unit time is $4\pi R^2 \sigma T^4$

Total energy received by the earth per time is

$$\frac{\pi r_0^2 R^2 \sigma T^4}{r^2}$$

35.(A)

Sol. $\frac{dT}{dt} = \frac{eA\sigma}{mc}(T^4 - T_0^4) = \frac{eA\sigma}{V\rho c}(T^4 - T_0^4)$

∴ Rate of cooling $R \propto A$

(As masses are equal, volume of each body must be equal because material is same)

i.e., rate of cooling depends on the area of cross section and we known that for a given volume the area of cross section will be minimum for sphere. It means the rate of cooling will be minimum in case of sphere.

So the temperature of sphere drops to room teperature at last.

36.(A)

Sol. Work done in converting 1 g of ice at – 10°C to steam at 100°C

= Heat supplied to raise temperature of 1 g of ice from – 10°C to 0°C($m \times c_{ice} \times \Delta T$)

+ Heat supplied to convert 1 g ice water at 0°C($m \times L_{ice}$)

+ Heat supplied to raise temperature of 1 g of water from 0°C to 100°C($m \times c_{water} \times \Delta T$)

+ Heat supplied to convert 1 g water into steam at 100°C[$m \times L_{vapour}$]

= [$m \times c_{ice} \times \Delta T$] + [$m \times L_{ice}$] + [$m \times c_{water} \times \Delta T$] + [$m \times L_{vapour}$]

= [1 × 0.5 × 10] + [1 × 80] + [1 × 1 × 100] + [1 × 540]

= 725 cal = 725 × 4.2 = 3045 J

37.(A)

Sol. According to Mayer's relation,

$$C_p - C_v = \frac{R}{m} = \frac{R}{28}$$

38.(D)

Sol. BC is isochoric.

$V_B > V_A$, $V_B = V_C$, $V_D > V_C$

39.(A)

Sol. Change in internal energy

$\Delta U = \mu C_v \Delta T$

$\Rightarrow U_2 - U_1 = \mu C_v (T_2 - T_1)$

Let initially $T_1 = 0$ so $U_1 = 0$ and finally $T_2 = T$ and $U_2 = U$

$$U = \mu C_v T = \mu T \times C_v = \frac{PV}{R} \times \frac{R}{\gamma - 1} = \frac{PV}{\gamma - 1}$$

(As $PV = \mu RT$, ∴ $\mu T = PV/R$ and $C_v = R/(\gamma - 1)$)

40.(C)

Sol. Here K_1 and K_2 are in parallel, so

$K = K_1 + K_2$

The frequency of oscillation is

$$f = \frac{1}{2\pi}\sqrt{\frac{K}{m}} = \frac{1}{2\pi}\sqrt{\frac{K_1+K_2}{m}}$$

When K_1 and K_2 are made four times their original values,

$K' = 4K_1 + 4K_2 = 4(K_1 + K_2)$

So the new frequency of oscillation is

$$f' = \frac{1}{2\pi}\sqrt{\frac{4(K_1+K_2)}{m}}$$

$$\therefore \frac{f'}{f} = \sqrt{4} = 2 \Rightarrow f' = 2f$$

41.(C)

Sol. $x = a\cos\omega t$

$a/2 = a\cos\omega t_0$

or $\cos\frac{\pi}{3} = \cos\omega t_0$

or $\frac{\pi}{3} = \omega t_0 \quad \therefore t_0 = \frac{\pi}{3\omega}$

$$v = \frac{dx}{dt} = -a\omega\sin\omega t$$

But $\omega = \frac{2\pi}{T} \qquad \therefore \bar{v} = \frac{3a}{T}$

42.(B)

43.(A)

Sol. $v \propto 1/l$

On doubling the length, frequency is halved

The word 'nearly' in the statement has been used keeping mind 'end correction'

44.(C)

Sol. Let the initial loudness of sound wave intensity I_1 be 100 dB.

Therefore,

$$L = 10\log\frac{I_1}{I_0}$$

$$\Rightarrow 100 = 10\log_{10}\frac{I_1}{I_0}$$

$$\Rightarrow \frac{I_1}{I_0} = 10^{10} \qquad \text{(i)}$$

Since the sound absorber attenuates the sound level by 20 dB,

$$(100-20)\,\text{dB} = 10\log\frac{I_2}{I_1}$$

$$\Rightarrow 80 = 10\log\frac{I_2}{I_0}$$

$$\Rightarrow \frac{I_2}{I_0} = 10^8 \qquad \text{(ii)}$$

Dividing (ii) by (i), we get

$$\frac{I_2}{I_1} = \frac{10^8}{10^{10}} = \frac{1}{100}$$

$$\Rightarrow I_2 = \frac{I_1}{100}$$

45.(D)

Sol. For the wave, $y = A\sin(kx - \omega t)$, the wave speed is ω/k and the maximum transverse string speed is $A\omega$.

Chemistry

136.(B)

Sol. 0.050 → 2

137.(D)

Sol. 32g = 6.022×10^{23} molecules

$$8g = \frac{6.022\times10^{23}}{32}\times8=1.55\times10^{23}.$$

138.(D)

Sol. 1 mole O_2 = 32g

1 molecule SO_2 = $\frac{64}{6.022\times10^{23}}g$

100 amu of U = $\frac{1}{6.022\times10^{23}}\times100g$

10 moles of H_2 = 2 × 10 = 20g

139.(B)

Sol. lower energy levels are not completely filled.

140.(A)

Sol. $\sqrt{2}\,\hbar$

141.(A)

Sol. $11^{Na} \rightarrow 1s^2\ 2s^2\ 2s^6\ 3s^1$

$\boxed{1}$ n = 3, l = 0, m = 0, s = +1/2

142.(C)

Sol. Value of m $= \pm \ell$

143.(B)

Sol. $4^{Be-} \rightarrow \underset{\text{Stable}}{\underset{\downarrow}{1s^2 2s^2}}$

144.(D)

Sol. Both have same no. of electrons.

145.(A)

Sol. Na > Mg > Al > Si

↓

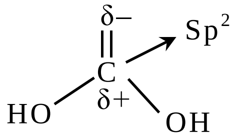
Having least attraction towards nucleus.

146.(B)

Sol. i.e of N is greater than O.

147.(A)

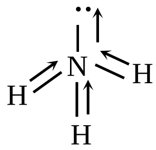
Sol.



148.(C)

149.(C)

Sol.



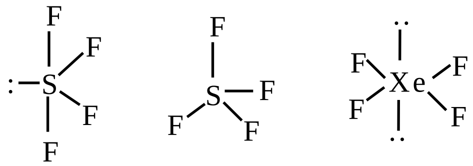
$\mu \neq 0$

150.(B)

Sol. Co has nounpaired e^-.

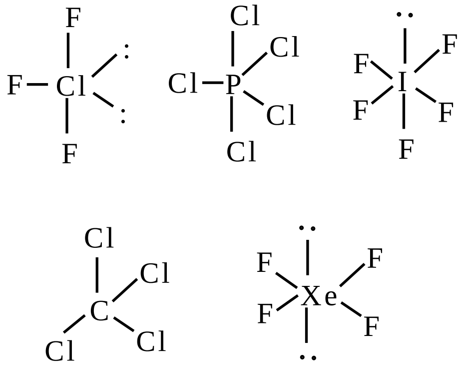
151.(D)

Sol.



152.(B)

Sol.



153.(C)

Sol. $z = \frac{Pv}{nRT}$

If z < 1

$\frac{Pv}{nRT} < 1$ or $Pv < nRT$

$v < \frac{nRT}{P}$

$\boxed{\text{or } v < 22.4}$

154.(B)

Sol. v vs T $\Rightarrow$ Charle's law

155.(C)

Sol. Loss of energy

156.(A)

Sol. at eq$^{\underline{n}}$ $\Delta G = 0$

as liq. Changes into gas

So, Δs = +ve

157.(D)

Sol. $H_2O(l) \rightarrow H_2O(g)$

$$\Delta_n g = 1$$

$$\Delta_{vap}H = 41\text{ kJ mol}^{-1}$$

$$\Delta U = \Delta H - \Delta_g nRT$$

$$= 41 - 1 \times 8.3 \times 10^{-3} \times 373$$

$$= 41 - 3.096 = 37.904\text{ kJ mol}^{-1}$$

158.(D)

Sol. $K = \frac{k_f}{k_b} = \frac{2}{1} = 2$

159.(A)

160.(C)

Sol. $K_p = \frac{P^4_{H_2}}{P^4_{H_2O}}$

161.(C)

Sol. Mix of weak acid and it's salt.

162.(D)

163.(B)

Sol. $K_{sp} = [Mg^{2+}][OH^-]^2$

$$10^{-12} = (0.01)[OH^-]^2$$

$$[OH^-] = 155$$

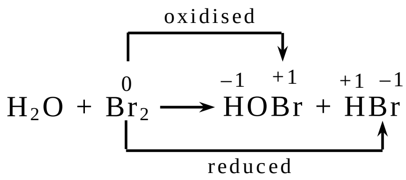
$$[H^+] = 10^{-9} \quad \text{or} \quad pH = 9$$

164.(D)

Sol. $\underset{\text{Acid}}{OH^{\ominus}} \xrightarrow{-H^{\oplus}} O^{2-}$

165.(B)

Sol.

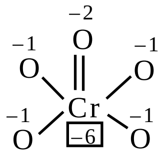


166.(C)

Sol. Oxidation state of Cl increases as well as decreases

167.(C)

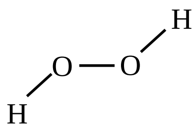
Sol.



168.(A)

169.(B)

Sol.



170.(A)

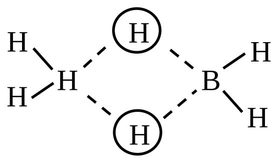
Sol. mobility ∝ size

171.(C)

172.(B)

173.(B)

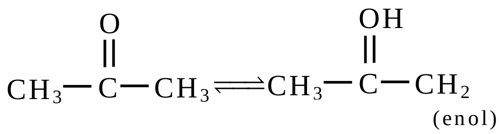
Sol.



174.(D)

175.(A)

Sol.



176.(A)

177.(B)

Sol. $C_6H_5CH_3 \xrightarrow{oxd^n} C_6H_5COOH$

$\downarrow$ NaOH

C_6H_5 COONa

$\downarrow$ NaOH

$C_6H_6 + NaCO_3$

178.(D)

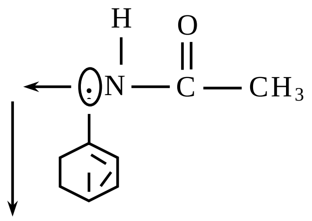
Sol. $CaC_2 + \longrightarrow C_2H_2 \text{ (A)} + Ca(OH)_2$

$\downarrow H_2SO_4 / Hg^{2+}$

$CH_3-CHO \text{ (B)}$

179.(D)

Sol.



Having lone pair

180.(A)

Sol.