NATIONAL ELIGIBILITY CUM ENTRANCE TEST

NEET(UG), 2015 (CODE-D)

Answers & Solutions

BIOLOGY

1. In is classic experiments on pea plants, Mendel did not use :
(1) Pod length
(2) Seed shape
(3) Flower position
(4) Seed colour

Answer Key: (1)

Solution: Mendel did not selected Pod length as a character for study

2. Which one of the following is not applicable to RNA?
(1) 5’ phosphoryl and 3’ hydroxyl ends
(2) Heterocyclic nitrogenous bases
(3) Chargaff’s rule
(4) Complementary base pairing

Answer Key: (3)

Solution: Chargaff's rule is applicable only for DNA.

3. Male gametophyte in angiosperms producers :
(1) Single sperm and a vegetative cell
(2) Single sperm and two vegetative cells
(3) Three sperms
(4) Two sperms and a vegetative cell

Answer Key: (4)

Solution: In angiosperms, pollen grain is first male gametophyte. Pollen grain divides into generative cell and vegetative cell. Generative cell further divides into two sperms.

4. Which of the following are not membrane – bound?
(1) Ribosomes
(2) Lysosomes
(3) Mesosomes
(4) Vacuoles

Answer Key: (1)

Solution: Ribosomes are made up of r-RNA and proteins.

5. The chitinous exoskeleton of arthropods is formed by the polymerization of :
(1) D- glucosamine
(2) N-acetyl glucosamine
(3) Lipoglycans
(4) Keratin sulphate and chondroitin sulphate

Answer Key: (2)

Solution: Exoskeleton of arthropods is made up of chitin. Chitin is a polymer of N-acetyl glucosamine.

6. Among China rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, how many plants have superior ovary?
(1) Six
(2) Three
(3) Four
(4) Five

Answer Key: (1)

Solution: Superior ovary is found in plants i.e. china rose, mustard, brinjal, potato, onion and tulip.

7. The function of the gap junction is to :
(1) Facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules.
(2) Separate two cells from each other
(3) Stop substance from leaking across a tissue
(4) Performing cementing to keep neighbouring cell together

Answer Key: (1)

Solution: Gap junctions are communicating junctions in animals which facilitates communication between two adjoining cells by protein bridges for rapid transfer of ions, small molecules and large molecules.

8. Which of the following immunoglobulins does constitute the largest percentage in human milk?
(1) IgM
(2) IgA
(3) IgG
(4) IgD

Answer Key: (2)

Solution: IgA is present in external body secretion including colostrum and milk. They provide naturally acquired passive immunity to child.

9. In mammalian eye, the 'fovea' is the center of the visual field, where :
(1) The optic nerve leaves the eye
(2) Only rods are present
(3) More rods than cones are found
(4) High density of cones occur, but has no rods

Answer Key: (4)

Solution: Fovea has highest visual acuity which has only cone cells and no rod cells.

10. Doctors use stethoscope to hear the sounds produced during each cardiac cycle. The second sound is heard when :
(1) Ventricular walls vibrate due to gushing in of blood from atria
(2) Semilunar valves close down after the blood flows into vessels from ventricles
(3) AV node receives signal from SA node

(4) AV valves open up

Answer Key: (2)

Solution: Second heart sound is 'DUP' which is produced during early ventricular diastole due to the sharp closure of semilunar valves.

11. Coconut water from a tender coconut is :
(1) Free nuclear endosperm
(2) Innermost layers of the seed coat
(3) Degenerated nucellus
(4) Immature embryo

Answer Key: (1)

Solution: Coconut water is free nuclear endosperm.

12. The cutting of DNA at specific location became possible with the discovery of :
(1) Probes
(2) Selectable markers
(3) Ligases
(4) Restriction enzymes

Answer Key: (4)

Solution: The cutting of DNA at specific locations became possible with the discovery of restriction enzymes called molecular scissors or knife.

13. Which of the following structure is not found in a prokaryotic cell?
(1) Ribosome
(2) Mesosome
(3) Plasma membrane
(4) Nuclear envelope

Answer Key: (4)

Solution: True nucleus is absent in prokaryotic cell.

14. Arrange the following events of meiosis in correct sequence :
(a) Crossing over
(b) Synapsis
(c) Terminalisation of chiasmata
(d) Disappearance of nucleolus
(1) (b), (a), (c), (d)
(2) (a), (b), (c), (d)
(3) (b), (c), (d), (a)
(4) (b), (a), (d), (c)

Answer Key: (1)

Solution: The sequence of event during meiosis are
(1) Synapsis (Zygotene)
(2) Crossing over (Pachytene)
(3) Terminalisation of chiasmata
(4) Disappearance of nucleolus

15. A column of water within xylem vessels of tall trees does not break under its weight because of :
(1) Tensile strength of water
(2) Lignification of xylem vessels
(3) Positive root pressure
(4) Dissolved sugars in water

Answer Key: (1)

Solution: The column of water within Xylem vessel of tall trees does not break under its weight due to high tensile strength of water. Tensile strength is the ability to resist pulling forces.

16. The imperfect fungi which are decomposers of litter and help in mineral cycling belong to :
(1) Basidiomycetes
(2) Phycomcetes
(3) Ascomycetes
(4) Deuteromycetes

Answer Key: (4)

Solution: Deuteromycetes - Imperfect fungi which are decomposers of litter and help in mineral cycling.

17. The structures that help some bacteria to attach to rocks and/or host tissue are :
(1) Fimbriae
(2) Mesosomes
(3) Holdfast
(4) Rhizoids

Answer Key: (1)

Solution: Fimbriae - Hollow tubular surface appendages, present in bacterial cell, which help in attachment to rocks and / or host tissues.

18. The DNA molecule to which the gene of interest is integrated for cloning is called :
(1) Vector
(2) Temple
(3) Carrier
(4) Transformer

Answer Key: (1)

Solution: The DNA molecule to which the gene of interest is integrated for cloning is called vector.

19. Pick up the **wrong** statement :
(1) Protista have photosynthetic and heterotrophic modes of nutrition
(2) Some fungi are edible
(3) Nuclear membrane is present in Monera
(4) Cell wall is absent in Animalia

Answer Key: (3)

Solution: The members of kingdom-Monera are prokaryotes they lack nuclear membrane.

20. Metagenesis refers to :
(1) Alternation of generation between asexual and sexual phases of an organism
(2) Occurrence a drastic change in form during post-embryonic development
(3) Presence of a segmented body and parthenogenetic mode of reproduction
(4) Presence of different morphic forms

Answer Key: (1)

Solution: In coelenterates, metagenesis is alternation of generation between polyp and medusa. Polyp reproduces asexually by budding to form medusa and medusa reproduces sexually to form polyp.

21. Which of the following events is not associated with ovulation in human female?
(1) Full development of Graafian follicle
(2) Release of secondary oocyte
(3) LH surge
(4) Decrease in estradiol

Answer Key: (4)

Solution: In 28 days reproductive cycle, ovulation occurs on 14th day due to LH surge. In the mid cycle, the level of FSH and estrogen are also high. The female gamete is released from the ovary in secondary oocyte stage after completing meiosis I.

22. Which of the following joints would allow no movement?
(1) Cartilaginous joint
(2) Synovial joint
(3) Ball and socket joint
(4) Fibrous joint

Answer Key: (4)

Solution: Fibrous joint are immovable joints where two bones are connected with the help of fibrous connective tissue.

23. Match the following list of microbes and their importance:

(a)	*Sacharomyces cerevisiae*	(i)	Production of immunosuppressive agents
(b)	*Monascus purpureus*	(ii)	Ripening of Swiss cheese
(c)	*Trichoderma polysporum*	(iii)	Commercial production of ethanol
(d)	*Propionibacterium shermanii*	(iv)	Production of blood-cholesterol lowering agents

	(a)	(b)	(c)	(d)
(1)	(iv)	(iii)	(ii)	(i)
(2)	(iv)	(ii)	(i)	(iii)
(3)	(iii)	(i)	(iv)	(ii)
(4)	(iii)	(iv)	(i)	(ii)

Answer Key: (4)

Solution:

Microbes	**Importance**
(1) Sacharomyces	– Commercial production of erevisiae ethanol.
(2) Monascus	– Production of blood purpureus cholesterol lowering agents
(3) Trichoderma polysporum	– Production of immunosuppressive agents
(4) Propionibacterium sharmanii	– Ripening of Swiss cheese

24. The UN conference Parties in climate change in the year 2012 was held at :
(1) Doha
(2) Lima
(3) Warsaw
(4) Durban

Answer Key: (1)

Solution: The United Nations Climate change conferences are yearly conferences and are known as Conference of the Parties (COP).

25. If you suspect major deficiency of antibodies in a person, to which of the following would you like for confirmation evidence?
(1) Serum albumins
(2) Haemocytes
(3) Serum globulins
(4) Fibrinogen in plasma

Answer Key: (3)

Solution: Antibodies are present in serum. They are glycoproteins and also called gammaglobulins synthesized in lymph nodes.

26. Chromatophores take part in :
(1) Growth
(2) Movement
(3) Respiration
(4) Photosynthesis

Answer Key: (4)

Solution: Chromatophores are photosynthetic apparatus in prokaryotes.

27. Acid rain is caused by increase in the atmospheric concentration of :
(1) SO_3 and SO
(2) CO_2 and CO
(3) O_3 and dust
(4) SO_2 and NO_2

Answer Key: (4)

Solution: During rainfall, SO_2 and NO_2 can decrease the pH of rain water.

28. During ecological succession :
(1) The establishment of a new biotic community is very fast in its primary phase
(2) The numbers and types of animals remain constant
(3) The changes lead to a community that is in near equilibrium with the environment and is called pioneer community
(4) The gradual and predictable change in species composition occurs in a given area

Answer Key: (4)

Solution: Ecological succession involves gradual and fairly predictable change in the species composition of a given area.

29. The oxygen evolved during photosynthesis comes from water molecules. Which one of the following pairs of elements is involved in this reaction?
(1) Manganese and Potassium
(2) Magnesium and Molybdenum
(3) Magnesium and Chlorine
(4) Manganese and chlorine

Answer Key: (4)

Solution: Manganese, chlorine and calcium help in photolysis of water during light reaction of photosynthesis.

30. Which of the following pairs is not correctly matched?

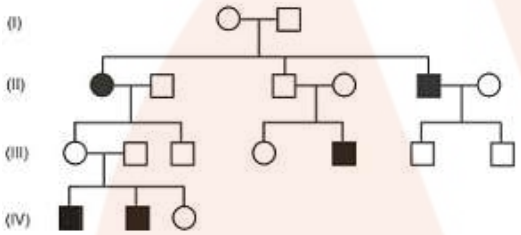
	Mode of eproduction	Example
(1)	Rhizome	Banana
(2)	Binary fission	Sargassum
(3)	Conidia	Penicillium
(4)	Offset	Water hyacinth

Answer Key: (2)

Solution:

Mode of Reproduction	Example
(1) Rhizome	Banana
(2) Binary fission	*Saecharomyces* (Yeast)
(3) Conidia	*Penicillium* (Ascomycetes)
(4) Offset	Water hyacinth

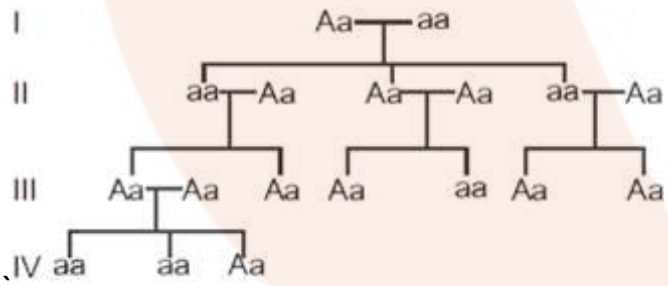
31. In the following human pedigree, the filled symbols represents the affected individuals. Identify the type of given pedigree.



(1) X-linked recessive
(2) Autosomal recessive
(3) X-linked dominant
(4) Autosomal dominant

Answer Key: (2)

Solution: The given pedigree represents inheritance of Autosomal recessive trait.



32. Which one of the following animals has two separate circulatory pathways?
(1) Lizard
(2) Whale
(3) Shark
(4) Frog

Answer Key: (2)

Solution: Whale is a mammal which has 4 chambered heart, so has complete separation of oxygenated and deoxygenated blood. Whale have double circulatory pathways: Systemic and pulmonary circulation.

33. Flowers are unisexual in
(1) Cucumber
(2) China rose
(3) Onion
(4) Pea

Answer Key: (1)

Solution: Flowers are unisexual in cucumber.
[Family - Cucurbitaceae]

34. Which one of the following fruits is parthenocarpic?
(1) Apple
(2) Jackfruit
(3) Banana
(4) Brinjal

Answer Key: (3)

Solution: Formation of fruit without fertilisation is called parthenocarpy. Banana is a parthenocarpic fruit therefore seedless.

35. A pleiotropic gene
(1) Is a gene evolved during Pliocene
(2) Controls a trait only in combination with another gene
(3) Controls multiple traits in an individual
(4) Is expressed only primitive plants

Answer Key: (3)

Solution: The gene which controls multiple traits in an individual.

36. Which of the following is not a function of the skeletal system?
(1) Storage of minerals
(2) Production of body heat
(3) Locomotion
(4) Production of erythrocytes

Answer Key: (2)

Solution: Production of body heat is the function of adipose tissue.

37. A jawless fish, which lays eggs in fresh water and whose ammocoetes larvae after metamorphosis return to the ocean is :
(1) *Myxine*
(2) *Neomyxine*
(3) Petromyzon
(4) Eptatretus

Answer Key: (3)

Solution: Petromyzon (Lamprey) is a migratory marine water jawless fish which shows anadromous migration. It spawns in fresh water, stops feeding and dies. Its larva (Ammocoetes) after metamorphosis will return to ocean.

38. Filiform apparatus is characteristic features of :
(1) Nucellar embryo
(2) Aleurone cell
(3) Synergids
(4) Generative cell

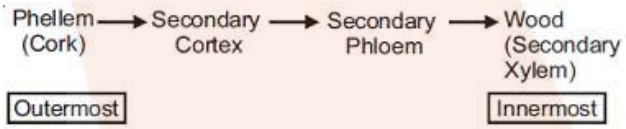
Answer Key: (3)

Solution: Filiform apparatus is finger like projections in eachsynergid.

39. Read the different components from (a) to (d) in the list given below and tell the correct order of the components with reference to their arrangement from outer side to inner side in a woody dicot stem :
(a) Secondary cortex
(b) Wood
(c) Secondary phloem
(d) Phellem
(1) (a), (b), (d), (c)
(2) (d), (a), (c), (b)
(3) (d), (c), (a), (b)
(4) (c), (d), (b), (a)

Answer Key: (2)

Solution: Sequence of different components of woody dicot stem from outerside to inner side is:



40. Which one of the following hormones is not involved in sugar metabolism?
(a) Aldosterone
(b) Insulin
(c) Glucagon
(d) Cortisone

Answer Key: (1)

Solution: Mineralocorticoid (Aldosterone) has no role in sugar metabolism. It helps in salt metabolism.

41. Golden rice is a genetically modified crop plant where the incorporated gene is meant for biosynthesis of :
(1) Vitamin C
(2) Omega 3
(3) Vitamin A
(4) Vitamin B

Answer Key: (3)

Solution: Golden rice is nutritionally enriched rich and is meant for biosynthesis of vitamin A.

42. Outbreeding is an important strategy of animal husbandry because it :
(1) Is useful in producing purelines of animals
(2) Is useful in overcoming inbreeding depression
(3) Expose harmful recessive genes that are eliminated by selection.
(4) Helps in accumulation of superior genes.

Answer Key: (2)

Solution: A single outcross (a type of outbreeding) is useful in overcoming inbreeding depression.

43. A gene showing codominance has :
(1) Alleles tightly linked on the same chromosome
(2) Alleles that are recessive to each other
(3) Both alleles independently expressed in the heterozygote
(4) One allele dominant on the other

Answer Key: (3)

Solution: Both alleles are independently expressed in heterozygote during codominance.

44. Which one of the following hormones though synthesised elsewhere, is stored and release by the master gland?
(A) Luteinizing hormone
(B) Prolactin
(C) Melanocyte stimulating hormone
(D) Antidiuretic hormone

Answer Key: (4)

Solution: Antidiuretic hormone is synthesized by the neurons of hypothalamus and stored in axon endings of posterior lobe of pituitary and released into the blood by posterior pituitary.

45. Increase in concentration of the toxicant at successive trophic levels is known as :
(1) Biodeterioration
(2) Biotransformation
(3) Biogeochemical cycling
(4) Biomagnification

Answer Key: (4)

Solution: Increase in concentration of toxic substances in successive trophic level.

46. Industrial melanism is an example of :
(1) Natural selection
(2) Mutation

(3) Neo Lamarckism
(4) Neo Darwinism

Answer Key: (1)

Solution: Industrial melanism is an example of natural selection.

47. The primary dentition in human differs from permanent dentition in not having one of the following type of teeth :
(1) Premolars
(2) Molars
(3) Incisors
(4) Canine

Answer Key: (1)

Solution: Dental formula of human adult (permanent dentition) $= \frac{2123}{2123}$.

Dental formula of child (primary dentition) = $\frac{2102}{2102}$

So premolars and third molar (last molar) are absent in primary dentition.

48. The wheat grain has an embryo with one large, shield-shaped cotyledon known as :
(1) Coleorhiza
(2) Scatellum
(3) Coleoptile
(4) Epiblast

Answer Key: (2)

Solution: Scutellum is the large persistent cotyledon in embryo of wheat grain.

49. The body cells in cockroach discharges their nitrogenous waste in the Haemolymph mainly in the form of :
(1) Potassium urate
(2) Urea
(3) Calcium carbonate
(4) Ammonia

Answer Key: (1)

Solution: Malpighian tubules keep floating in haemolymph from where potassium waste diffuses into the tubule. Urate crystals are crystals of uric acid.

50. Which of the following biomolecules does have a phosphodiester bond?
(1) Monosaccharides in a polysaccharide
(2) Amino acids in a polypeptide
(3) Nucleic acids in a nucleotide
(4) Fatty acids in a diglyceride

Answer Key: (3)

Solution: Phosphodiester bond is formed between two nucleotides of nucleic acid.

51. The term ''linkage'' was coined by :
(1) T. Boveri
(2) G. Mendel
(3) W. Sutton
(4) T.H. Morgan

Answer Key: (4)

Solution: The term "linkage" was coined by T.H. Morgan.

52. Which one is a **wrong** statement?
(1) *Mucor* has biflagellate zoospores
(2) Haploid endoperm is typical feature of gymnosperms
(3) Brown algae have chlorophyll a and c, and fucoxanthin
(4) Archegonia are found in Bryophyta, Pteridophyta and Gymnosperms

Answer Key: (1)

Solution: *Mucor* has non-motile spore i.e. sporangiospores.

53. Ectopic pregnancies are referred to as :
(1) Implantation of embryo at side other than uterus
(2) Implantation of defective embryo in the uterus
(3) Pregnancies terminated due to hormonal imbalance
(4) Pregnancies with genetic abnormality.

Answer Key: (1)

Solution: Any extra uterine pregnancy is ectopic pregnancy. Implantation can occur in the wall of abdominal cavity, ovaries but 90-95% of ectopic pregnancies are tubal pregnancy where implantation occurs in fallopian tube.

54. Most animals that live in deep oceanic waters are :
(1) Secondary consumers
(2) Tertiary consumers
(3) Detritivores
(4) Primary consumers

Answer Key: (3)

Solution: Detritivores are an important aspect of many ecosystem. They can live on any soil with organic component, including marine ecosystem.

55. Which of the following diseases is caused by a protozoan?
(1) Influenza
(2) Babesiosis
(3) Blastomycosis

(4) Syphilis

Answer Key: (2)

Solution: Babesiosis is a disease caused by a protozoan, Babesia bigemina. The vector is tick, so disease is also called tick fever in cattle.

56. In which of the following interaction both partners are adversely affected?
(1) Predation
(2) Parasitism
(3) Mutualism
(4) Competition

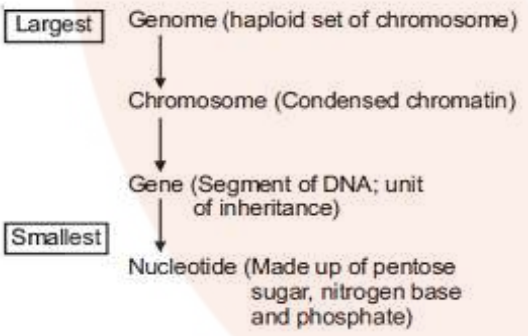
Answer Key: (4)

Solution: During competition, both partners are adversely affected.

57. Identify the correct order of organization of genetic material from largest to smallest :
(1) Genome, chromosomes, nucleotide, gene
(2) Genome, chromosome, gene, nucleotide
(3) Chromosome, genome, nucleotide, gene
(4) Chromosome, gene, genome, nucleotide

Answer Key: (2)

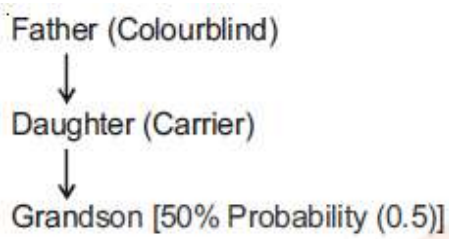
Solution: Order of organisation of genetic material



58. A colour blind man marries a women with normal sight who has no history of colour blindness in her family. What is the probability of their grandson being colour blind?
(1) 1
(2) Nil
(3) 0.25
(4) 0.5

Answer Key: (4)

Solution:



59. In photosynthesis, the light-independent reactions take place at :
(1) Photosystem I
(2) Photosystem II
(3) Stromal matrix
(4) Thylakoid lumen

Answer Key: (3)

Solution: Light-independent reactions or Dark reactions occur in stroma/ stromal matrix. During these reactions carbon dioxide is reduced to carbohydrates.

60. In which of the following both pairs have correct combination?

(1)	Gaseous nutrient cycle	Carbon and Sulphur
	Sedimentary nutrient cycle	Nitrogen and Phosphorus
(2)	Gaseous nutrient cycle	Nitrogen and Sulphur
	Sedimentary nutrient cycle	Carbon and phosphorus
(3)	Gaseous nutrient cycle	Sulphur and Phosphorus
	Sedimentary nutrient cycle	Carbon and Nitrogen
(4)	Gaseous nutrient cycle	Carbon and Nitrogen
	Sedimentary nutrient cycle	Sulphur and phosphorus

Answer Key: (4)

Solution: Sulphur and phosphorus are found on earth crust in the form of rocks

61. The introduction of t-DNA into plants involves :
(1) Altering the pH of the soil, then heat-shocking the plants
(2) Exposing the plants to cold for a brief period
(3) Allowing the plant roots to stand in water
(4) Infection of the plant by Agrobacterium tumefaciens

Answer Key: (4)

Solution: When Agrobacterium tumifaciens infects the host plant, it will transfer a part of DNA called t-DNA without any human interference so called natural genetic engineer.

62. The wings of a bird and the wings of an insect are :
(1) Analogous structures and represent convergent evolution
(2) Phylogenetic structures and represent divergent evolution
(3) Homologous structures and represent convergent evolution

(4) Homologous structures and represent divergent evolution

Answer Key: (1)

Solution: The wings of a bird and an insect are analogous structure which differ in structure and origin but perform similar functions and represent convergent evolution.

63. Root pressure is usually acidic because
(1) Low osmotic potential in soil
(2) Passive absorption
(3) Increase in transpiration
(4) Active absorption

Answer Key: (4)

Solution: As various ions from the soil are actively transported into the vascular tissues of the roots, water follows and increases the pressure inside the xylem i.e., root pressure (positive pressure).

64. Human urine is usually acidic because
(1) Excreted plasma proteins are acidic
(2) Potassium and sodium exchange generates acidity
(3) Hydrogen ions are actively secreted into the filtrate
(4) The sodium transporter exchanges one hydrogen ion for each sodium ion, in peritubular capillaries.

Answer Key: (3)

Solution: Tubular secretion maintains the pH and ionic balance of body fluids in which hydrogen ions are actively secreted into the filterate and bicarbonate ions are reabsorbed.

65. A protoplast is a cell :
(1) Without nucleus
(2) Undergoing division
(3) Without cell wall
(4) Without plasma membrane

Answer Key: (3)

Solution: Plant cell — Cell wall = Protoplast

66. The species confined to a particular region and not found elsewhere termed as :
(1) Alien
(2) Endemic
(3) Rare
(4) Keystone

Answer Key: (2)

Solution: The species confined to a particular region and not found elsewhere is termed as Endemic.

67. Select the wrong statement :
(1) W.M. Stanley showed that viruses could be crystallized
(2) The term '*contagium vivum fluidum'* was coined by M.W. Beijerinek
(3) Mosaic disease in tobacco and AIDS in human being are caused by viruses
(4) The viroids were discovered by D.J. Jvanowski

Answer Key: (4)

Solution: The viroids were discovered by T.O. Diener.

68. Axile placentation is present in :
(1) Lemon
(2) Pea
(3) Argemone
(4) Dianthus

Answer Key: (1)

Solution: The number of ovules are arranged on central axis in multilocular ovary.

69. A childless couple can be assisted to have a child through a technique called GIFT. The full form of this techniques is :
(1) Gamete intra fallopian transfer
(2) Gamete internal fertilization and transfer
(3) Germ cell internal fallopian transfer
(4) Gamete inseminated fallopian transfer

Answer Key: (1)

Solution: GIFT - Gamete intra fallopian transfer

70. Destruction of the anterior horn cells of the spinal cord would result in loss of :
(1) Voluntary motor impulses
(2) Commissural impulses
(3) Integrating impulses
(4) Sensory impulses

Answer Key: (1)

Solution: Anterior horn cells are ventral horn cells of spinal cord which consists of motor neurons.

71. During biological nitrogen fixation, inactivation of nitrogenase by oxygen poisoning is prevented by:

(1) Xanthophyll

(2) Carotene

(3) Cytochrome

(4) Leghaemoglobin

Answer Key: (4)

Solution: During Biological nitrogen fixation, inactivation of nitrogenase by oxygen poisoning is prevented by pink coloured oxygen scavenger pigment leghaemogolobin.

72. An association of individuals of different species living in the same habitat and having functional interections is:

(1) Biotic community

(2) Ecosystem

(3) Population

(4) Ecological niche

Answer Key: (1)

Solution: Populations of different species occurring in a habitat comprise the biotic community

73. Name the pulmonary disease in which alveolar surface area involved in gas exchange is drastically reduced due to damage in the alveolar walls.

(1) Emphysema

(2) Pneumonia

(C) Asthama

(D) Pleurisy

Answer Key: (1)

Solution: Emphysema is mainly due to cigarette smoking in which the walls of alveoli are damaged that leads to reduction in surface area for gaseous exchange.

74. Balbiani rings are sites of:

(1) Nucleotide synthesis

(2) Polysaccharide synthesis

(3) RNA and protein synthesis

(4) Lipid synthesis

Answer Key: (3)

Solution: Balbiani rings are the large chromosome puff of polytene chromosomes. These are the sites of RNA and protein synthesis.

75. Match the columns and identify the correct option.

	Column I		Column II
(a)	Thylakoids	(i)	Disc-Shaped sacs in Golgi apparatus
(b)	Cristae	(ii)	Condensed structure of DNA

(c)	Cisternae	(iii)	Flat membranous sacs in stroma
(d)	Chromatin	(iv)	Infoldings in mitochondria

(a) (b) (c) (d)
(1) (iii) (iv) (i) (ii)
(2) (iii) (i) (iv) (ii)
(3) (iii) (iv) (ii) (i)
(4) (iv) (iii) (i) (ii)

Answer Key: (1)

Solution: Thylakoids – Flat membranous sacs in stroma of chloroplast.

Cristae – Infoldings in mitochondria

Cisternae – Disc-shaped sacs in golgiapparatus

Chromatin – Condensed structure of DNA.

76. Cellular organelles with membranes are:

(1) Chromosomes, ribosomes and endoplasmic reticulum

(2) Endoplasmic reticulum, ribosomes and nuclei

(3) Lysosomes, Golgi apparatus and mitochondria

(4) Nuclei, ribosomes and mitochondria

Answer Key: (3)

Solution: Lysosomes, Golgi apparatus and mitochondria are membrane bound organelles.

77. Auxin can be bioassayed by:

(1) Hydroponics

(2) Potometer

(3) Lettuce hypocotyl elongation

(4) Avena coleoptile curvature

Answer Key: (4)

Solution: Avena coleoptile curvature test is the bioassay forauxin.

78. Which of the following layers in an antral follicle is acellular?

(1) Theca interna

(2) Stroma

(3) Zona pellucida

(4) Granulosa

Answer Key: (3)

Solution: Zona pellucida is non-cellular membrane made up of glycoproteins. It is secreted by secondary oocyte in Graafian follicle.

79. Satellite DNA is important because it:

(1) Shows high degree of polymorphism in population and also the same degree of polymorphism in an individual, which is heritable from parents to children.

(2) Does not cade for proteins and is same in all members of the population.

(3) Codes for enzymes needed for DNA replication.

(4) Codes for proteins needed in cell cycle.

Answer Key: (1)

Solution: Satellite DNA are the repetitive DNA which do not code for any protein. They show high degree of polymorphism and form basis of DNA fingerprinting.
Since DNA from every tissue from an individual show the same degree of polymorphism, they become very useful identification tool in forensic applications.

80. Cell wall is absent in:

(1) Funaria

(2) Mycoplasma

(3) Nostoc

(4) Aspergillus

Answer Key: (2)

Solution: Mycoplasma is wall-less smallest living organism

81. In angiosperms, microsporogensis and megasporogenesis:

(1) Form gametes without further divisions

(2) Involve meiosis

(3) Occur in ovule

(4) Occur in anther

Answer Key: (2)

Solution: In angiosperms, microsporogenesis and megasporogenesis involve meiosis

82. Roots play insignificant role in absorption of water in :

(1) Pistia

(2) Pea

(3) Wheat

(4) Sunflower

Answer Key: (1)

Solution: Pistia - roots are poorly developed as it is free floating hydrophyte.

83. Which of the following are most suitable indicators of SO_2 Pollution in the environment?

(1) Conifers

(2) Algae

(3) Fungi

(4) Lichens

Answer Key: (4)

Solution: Lichens do not grow in $SO2$ polluted regions therefore they indicate SO2 pollution in air. Phycobionts of lichen are sensitive to SO2.

84. Grafted kidney may be rejected in a patient due to:

(1) Cell-mediated immune response

(2) Passive immune response

(3) Innate immune response

(4) Humoral immune response

Answer Key: (1)

Solution: Cell mediated immunity (CMI) is responsible for graft rejection.

85. Body having meshwork of cells, internal cavities lined with food filtering flagellated cells and indirect development are the characteristics of phylum:

(1) Porifera

(2) Mollusca

(3) Protozoa

(4) Coelenterata

Answer Key: (1)

Solution: In poriferans, the body is loose aggregate of cells (meshwork of cells). Internal cavities and canals are lined with food filtering flagellated cells i.e. choanocyte/collar cell. Choanocytes help in filter feeding.

86. In which group of organisms the cell walls form two thin lapping shells which fit together

(1) Euglenoids

(2) Dinoflagellates

(3) Slime moulds

(4) Chrysophytes

Answer Key: (4)

Solution: Chrysophytes are photosynthetic protists. They have overlapping cell wall like soap box.

87. Choose the wrong statement:

(1) Neurospora is used in the study of biochemical genetics

(2) Morels and truffles are poisonous mushrooms

(3) Yeast is unicellular and useful in fermentation

(4) Penicillium is multicellular and produces antibiotcs

Answer Key: (2)

Solution: Morels and truffles are edible fungi belong to class ascomycetes.

88. In human females, meiosis-II is not completed until?

(1) Fertilization

(2) Uterine implantation

(3) Birth

(4) Puberty

Answer Key: (1)

Solution: In human females, meiosis II is completed after the entry of sperm into the cytoplasm of secondary oocyte at the time of fertilisation leading to the formation of ovum and IInd polar body.

89. Eutrophication of water bodies leading to killing of fishes is mainly due to non-availability of:

(1) Light

(2) Essential Minerals

(3) Oxygen

(4) Food

Answer Key: (3)

Solution: During eutrophication of water bodies, BOD level increases due to rapid growth of microbes.

90. The enzyme that is not present in succus entericus is:

(1) Nucleases

(2) Nucleosidase

(3) Lipase

(4) Maltase

Answer Key: (1)

Solution: Succus entericus is intestinal juice contains maltase, lipase, nucleosidase. Nucleases are the enzymes of pancreatic juice.

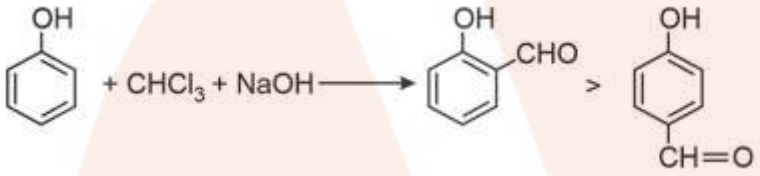
Chemistry

91. Reaction of phenol with chloroform in presence of dilute sodium hydroxide finally introduces which one of the following functional group?

(1) $-CH_2Cl$
(2) $-COOH$
(3) $-CHCl_2$
(4) $-CHO$

Solution: (4)

Reimer Tieman reaction



92. If the equilibrium constant for $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is K, the equilibrium constant for $\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO(g)$ will be:

(1) $K^{\frac{1}{2}}$
(2) $\frac{1}{2}K$
(3) K
(4) K^2

Solution: (1)

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g) \quad ; K$$

$$\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO(g) \; ; K'$$

$$K = \frac{[NO]^2}{[N_2]\;\;[O_2]}$$

$$K' = \frac{NO}{[N_2]^{1/2}[O_2]^{1/2}}$$

$$\therefore K' = \sqrt{K}$$

93. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample?
(Atomic weight: Mg = 24)

(1) 75
(2) 96
(3) 60

(4) 84

Solution: (4)

$\mathrm{MgCO_3(s) \longrightarrow MgO(s) + CO_2(g)}$

$\text{Moles of } \mathrm{MgCO_3} = \frac{20}{84} = 0.238 \text{ mol}$

From above equation.

1 mole $\mathrm{MgCO_3}$ gives 1 mole MgO

$\therefore$ 0.238 mole $\mathrm{MgCO_3}$ will give 0.238 mole MgO

$= 0.238 \times 40 \text{ g} = 9.523 \text{ g MgO}$

$\text{Practical yield of MgO} = 8 \text{ g MgO}$

$\therefore \text{ \% Purity} = \frac{8}{9.523} \times 100 = 84\%$

94. The number of water molecules is maximum in:
(1) 18 molecules of water
(2) 1.8 gram of water
(3) 18 gram of water
(4) 18 moles of water

Solution: (4)

$\because$ 1 mole water $= 6.02 \times 10^{23}$ moleucles

$\therefore$ 18 mole water $= 18 \times 6.02 \times 10^{23}$ molecules

So, 18 mole water has maximum number of molecules.

95. The formation of the oxide ion, $\mathrm{O^{2-}(g)}$, from oxygen atom requires first an exothermic and then an endothermic step as shown in below:

$\mathrm{O(g) + e^- \longrightarrow O^-(g)} \;\; ; \;\; \Delta_f H^{\ominus} = -141 \text{ kJ mol}^{-1}$

$\mathrm{O^-(g) + e^- \longrightarrow O^{2-}(g)} \; ; \;\; \Delta_f H^{\ominus} = +780 \text{ kJ mol}^{-1}$

Thus process of formation of $\mathrm{O^{2-}}$ in gas phase is unfavourable though $\mathrm{O^{2-}}$ is isoelectronic with neon. It is due to the fact that,

(1) Electron repulsion outweighs the stability gained by achieving noble gas configuration.
(2) $\mathrm{O^-}$ ion has comparatively smaller size than oxygen atom.
(3) Oxygen is more electronegative.
(4) Addition of electron in oxygen results in larger size of the ion.

Solution: (1)

96. What is mole fraction of the solute in a 1.00 m aqueous solution?
(1) 0.177

(2) 1.770
(3) 0.0354
(4) 0.0177

Solution: (4)

1.0 m solution means 1 mole solute is present in 1000 g water.

$n_{H_2O} = 55.5 \text{ mol } H_2O$

$$X_{Solute} = \frac{n_{Solute}}{n_{Solute} + n_{H_2O}} = \frac{1}{1 + 55.5} = 0.0177$$

97. The rate constant of the reaction $A \longrightarrow B$ is 0.6×10^{-3} mole per second. If the concentration of A is 5M, then concentration of B after 20 minutes is:
(1) 1.08 M
(2) 3.60 M
(3) 0.36 M
(4) 0.72 M

Solution: (4)

For zero order reaction:

$x = K \cdot t$

$= 0.6 \times 10^{-3} \times 20 \times 60$

$x = 0.72 \text{ M}$

98. Decreasing order of stability of O_2, O_2^-, O_2^+ and O_2^{2-} is:
(1) $O_2^+ > O_2 > O_2^- > O_2^{2-}$
(2) $O_2^{2-} > O_2^- > O_2 > O_2^+$
(3) $O_2 > O_2^+ > O_2^{2-} > O_2^-$
(4) $O_2^- > O_2^{2-} > O_2^+ > O_2$

Solution: (1)

Given species: $O_2, O_2^-, O_2^+, O_2^{2-}$

Total number of electrons

$O_2 \longrightarrow 16e^-$

$O_2^- \longrightarrow 17e^-$

$O_2^+ \longrightarrow 15e^-$

$O_2^{2-} \longrightarrow 18e^-$

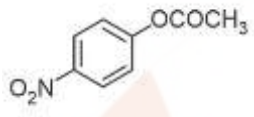
	O_2^+	O_2	O_2^-	O_2^{2-}
Bond order	2.5	2	1.5	1

Stability × Bond order

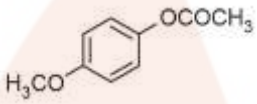
Stability order $[O_2^+ > O_2 > O_2^- > O_2^{2-}]$

99. Which one of the following esters gets hydrolyzed most easily under alkaline conditions?

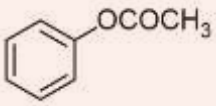
(1)



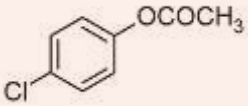
(2)



(3)



(4)



Solution: (1)

EWG (Electron withdrawing group) increases reactivity towards nucleophilic substitution reaction. $-NO_2$ is strong electron withdrawing group.

100. On heating which of the following releases CO_2 most easily?

(1) K_2CO_3
(2) Na_2CO_3
(3) $MgCO_3$
(4) $CaCO_3$

Solution: (3)

Thermal stability order

$$K_2CO_3 > Na_2CO_3 > CaCO_3 > MgCO_3$$

Therefore $MgCO_3$ releases CO_2 most easily.

$$MgCO_3 \xrightarrow{\Delta} MgO + CO_2$$

101. Which one of the following pairs of solution is not an acidic buffer?

(1) $HClO_4$ and $NaClO_4$
(2) CH_3COOH and CH_3COONa
(3) H_2CO_3 and Na_2CO_3
(4) H_3PO_4 and Na_3PO_4

Solution: (1)

Strong acid with its salt cannot form buffer solution. $HClO_4$ and $NaClO_4$ cannot act as an acidic buffer.

102. The sum of coordination number and oxidation number of metal M in the complex $[M(en)_2(C_2O_4)]Cl$ (Where en is ethylenediamine) is:

(1) 9
(2) 6
(3) 7
(4) 8

Solution: (1)

$[M(en)_2(C_2O_4)]Cl$

Oxidation state of M = +3

Coordination number of M = 6

Sum of oxidation state + Coordination number = 3 + 6 = 9

103. Which of the statements given below is incorrect?

(1) Cl_2O_7 is an anhydride of perchloric acid
(2) O_3 molecule is bent.
(3) ONF is isoelectronic with O_2N^-
(4) OF_2 is an oxide of fluorine.

Solution: (4)

i. No. of electron in ONF = 24

No. of electron in $NO_2^- = 24$

Both are isoelectronic.

ii. OF_2 is a fluoride of oxygen not oxide of fluorine because EN of fluorine is more than oxygen.
$OF_2 = \text{Oxygen difluoride}$

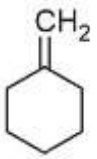
iii. Cl_2O_7 is an anhydride of perchloric acid.

$$2HClO_4 \xrightarrow{\Delta,-H_2O} Cl_2O_7$$

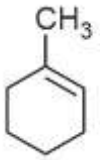
iv. O_3 molecules is bent shape.

104. In the reaction with HCl, an alkene reacts in accordance with the Markovnikov's rule, to give a product 1-chloro-1-methylcyclohexane. The possible reaction alkene is:

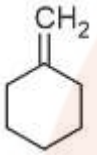
(1)



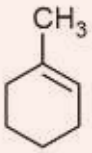
(2)



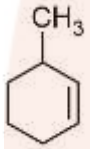
(3)



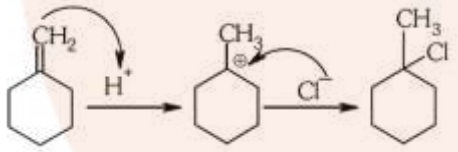
and

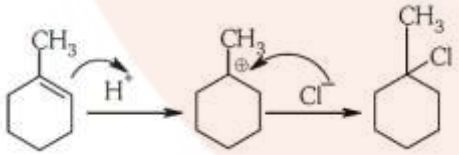


(4)



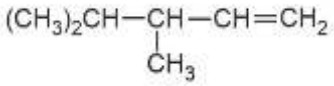
Solution: (3)





105. 2,3-Dimethyl-2-butene can be prepared by heating which of the following compounds with a strong acid?

(1)

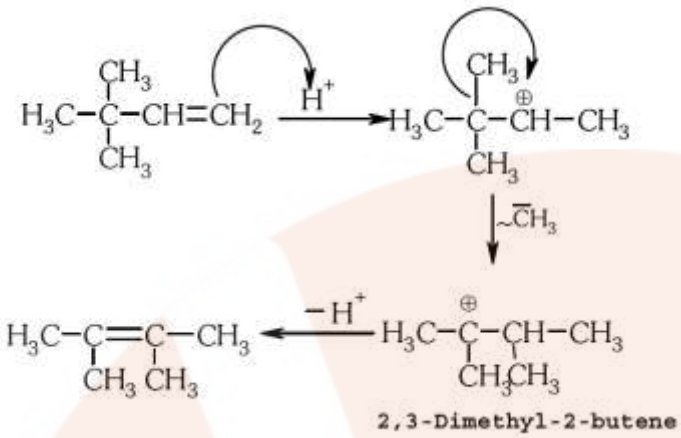


(2) $(CH_3)_3C-CH=CH_2$

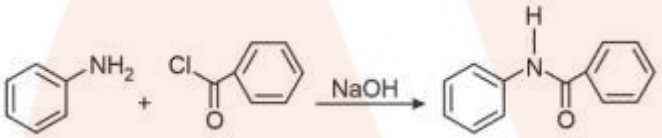
(3) $(CH_3)_2C=CH-CH_2-CH_3$

(4) $(CH_3)_2CH-CH_2-CH=CH_2$

Solution: (2)



106. The following reaction



Is known by the name:

(1) Friedel-Craft's reaction
(2) Perkin's reaction
(3) Acetylation reaction
(4) Schotten-Baumen reaction

Solution: (4)

Benzoylation of aniline is an example of Schotten-Bauman reaction.

107. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with:
(1) Iron (II) sulphide
(2) Carbon monoxide
(3) Copper (I) sulphide
(4) Sulphur dioxide

Solution: (3)

Self reduction

$$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2 \uparrow$$

108. If Avogadro number N_A , is changed from $6.022 \times 10^{23}\ mol^{-1}$ to $6.022 \times 10^{20}\ mol^{-1}$, this would change:
(1) The definition of mass in units of grams
(2) The mass of one mole of carbon
(3) The ratio of chemical species to each other in a balanced equation.
(4) The ratio of elements to each other in a compound.

Solution: (2)

∵ Mass of 1 mol $(6.022 \times 10^{23}$ atoms) of carbon = 12g

If Avogadro Number (N_A) is changed then mass of 1 mol $(6.022 \times 10^{20}$ atom) of carbon

$$= \frac{12 \times 6.022 \times 10^{20}}{6.022 \times 10^{23}} = 12 \times 10^{-3} \text{ g}$$

109. The variation of the boiling points of the hydrogen halides is in the order $HF > HI > HBr > HCl$. What explains the higher boiling point of hydrogen fluoride?

(1) The electronegativity of fluorine is much higher than for other elements in the group.
(2) There is strong hydrogen bonding between HF molecules.
(3) The bond energy of HF molecules is greater than in other hydrogen halides.
(4) The effect of nuclear shielding is much reduced in fluorine which polarizes the HF molecule.

Solution: (2)

Due to strong H-bonding in HF molecule, boiling point is highest for HF.

$$HF > HI > HBr > HCl$$

110. Which of the following reaction(s) can be used for the preparation of alkyl halides?

I. $CH_3CH_2OH + HCl \xrightarrow{\text{Anhyd.}ZnCl_2}$
II. $CH_3CH_2OH + HCl \longrightarrow$
III. $(CH_3)_3COH + HCl \longrightarrow$
IV. $(CH_3)_2CHOH + HCl \xrightarrow{\text{Anhyd.}ZnCl_2}$

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

Solution: (1)

I and IV can be used due to presence of anhydrous $ZnCl_2$ (III) gives alkyl halide due to formation of more stable carbocation.

111. The name of complex ion, $[Fe(CN)_6]^{3-}$ is :

(1) Hexacyanoiron (III) ion
(2) Hexacyanitoferrate (III) ion
(3) Tricyanoferrate (III) ion
(4) Hexacyanidoferrate (III) ion

Solution: (4)

$[Fe(CN)_6]^{3-}$

Hexacyanidoferrate (III) ion

112. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified $KMnO_4$ for complete oxidation?

(1) $FeSO_4$
(2) $FeSO_3$
(3) FeC_2O_4
(4) $Fe(NO_2)_2$

Solution: (1)

$MnO_4^- \longrightarrow Mn^{2+}$; Change in oxidation no. = 5

In option,

i. $Fe^{2+} \longrightarrow Fe^{3+}$

Change in oxidation no. = 1

ii. $Fe^{2+} \longrightarrow Fe^{3+}$

Change in oxidation no. = 1

$SO_3^{2-} \longrightarrow SO_4^{2-}$

Change in oxidation no. = 2

$= 1 + 2 = 3$

iii. $Fe^{2+} \longrightarrow Fe^{3+}$

Change in oxidation no. = 1

$C_2O_4^{2-} \longrightarrow 2CO_2$

Change in oxidation no. = 2

$= 1 + 2 = 3$

iv. $Fe^{2+} \longrightarrow Fe^{3+}$

Change in oxidation no. = 1

$2NO_2^- \longrightarrow 2NO_3^-$

Change in oxidation no. = 4

$= 1 + 4 = 5$

113. In which of the following pairs, both the species are not isostructural?

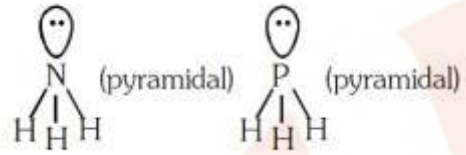
(1) $SiCl_4, PCl_4^+$
(2) Diamond, silicon carbide
(3) NH_3, PH_3

(4) XeF_4, XeO_4

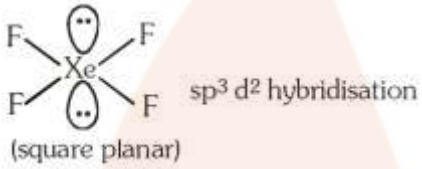
Solution: (4)

i. Hybridization of NH_3 $[\sigma = 3, lp = 1]$

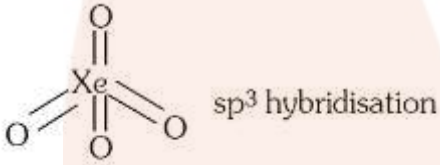
sp^3 geometry : Tetrahedral



ii. Structures of XeF_4 is square planar.

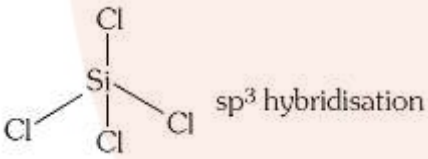


Structure of XeO_4 is tetrahedral

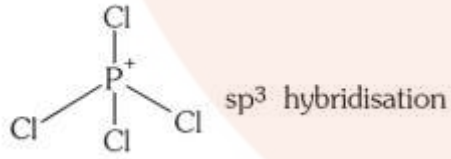


So XeF_4 and XeO_4 are not isostructural.

iii. Structure of $SiCl_4$ is tetrahedral.



Structure of PCl_4^+ is tetrahedral.



iv. Diamond and SiC both are isostructural because both have tetrahedral arrangement and central atom is sp^3 hybridized.

114. Caprolactum is used for the manufacture of:

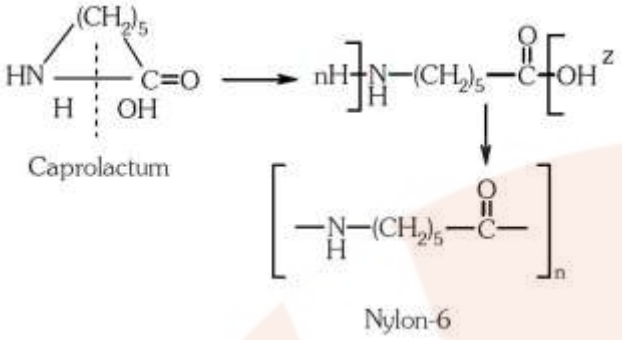
(1) Nylon-6

(2) Teflon

(3) Terylene

(4) Nylon-6,6

Solution: (1)



115. The hybridization involved in complex $[Ni(CN)_4]^{2-}$ is: (Atomic number of Ni = 28)

(1) dsp^2
(2) sp^3
(3) d^2sp^2
(4) d^2sp^3

Solution: (1)

$[Ni(CN)_4]^{2-}$

Oxidation state of Ni is +2

$x - 4 = 2$

$x = +2$

116. What is the mass of the precipitate formed when 50 mL of 16.9% solution of $AgNO_3$ is mixed with 50 mL of 5.8% NaCl solution?

(Ag = 107.8, N = 14, O = 16, Na = 23, Cl = 35.5)

(1) 28 g
(2) 3.5 g
(3) 7 g
(4) 14 g

Solution: (3) 16.9 g $AgNO_3$ is present in 100 mL solution.

$\therefore$ 8.45 g $AgNo_3$ is present in 50 mL solution

5.8 g NaCl is present in 100 mL solution

$\therefore$ 2.9 g $NaCl$ is present in 50 mL solution

	$AgNO_3$	+ $NaCl$	$\rightarrow$ $AgCl$	+ $NaNO_3$
	$\frac{8.45}{170}$ mol	$\frac{2.9}{58.5}$		
	= 0.049 mol	= 0.049 mol	$\rightarrow$ 0	0
After reaction	0	0	$\rightarrow$ 0.049 mol	0.049 mol

Mass of AgCl precipitated

$= 0.049 \times 143.5$ g

$= 7$ g AgCl

117. Gadolinium belongs of 4f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium?

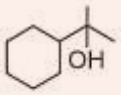
(1) $[Xe]4f^8 6d^2$

(2) $[Xe]4f^9 5s^1$

(3) $[Xe]4f^7 5d^1 6s^2$

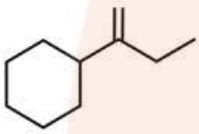
(4) $[Xe]4f^6 5d^2 6s^2$

Solution: (3) $_{64}Gd = {}_{54}[Xe]6s^2\ 4f^7\ 5d^1$

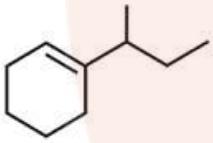
118. Which of the following is not the product of dehydration of 

?

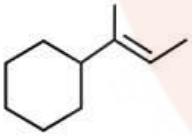
(1)



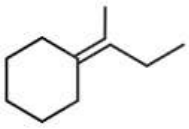
(2)



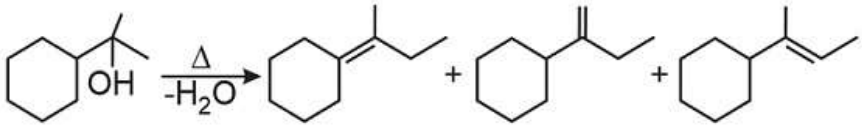
(3)



(4)



Solution: (2)



Intermediate carbocation (more stable). No rearangement in C^+ takes place.

119. A gas such as carbon monoxide would be most likely to obey the ideal gas law at:
(1) High temperatures and low pressures
(2) Low temperatures and high pressures
(3) High temperatures and high pressures
(4) Low temperatures and low pressures

Solution: (1) Real gases show ideal gas behaviour at high temperatures and low pressures.

120. The stability of +1 oxidation state among Al, Ga, In and TI increases in the sequence:
(1) $\mathrm{Ga} < \mathrm{In} < \mathrm{Al} < \mathrm{TI}$
(2) $\mathrm{Al} < \mathrm{Ga} < \mathrm{In} < \mathrm{TI}$
(3) $\mathrm{TI} < \mathrm{In} < \mathrm{Ga} < \mathrm{A}$
(4) $\mathrm{In} < \mathrm{TI} < \mathrm{Ga} < \mathrm{Al}$

Solution: (2) Stability of +1 oxidation state due to inert pair effect $\mathrm{TI} < \mathrm{In} < \mathrm{Ga} < \mathrm{Al}$.

121. What is the pH of the resulting solution when equal volumes of 0.1 m NaOH and 0.01 M HCl are mixed?
(1) 12.65
(2) 2.0
(3) 7.0
(4) 1.04

Solution: (1) $\mathrm{N_1V_1} - \mathrm{N_2V_2} = \mathrm{N.V.}$

$$0.1 \times 1 - 0.01 \times 1 = \mathrm{N} \times 2$$

$$[\mathrm{OH^-}] = \mathrm{N_R} = 0.\frac{09}{2} = 0.045\ \mathrm{N}$$

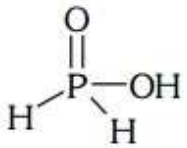
$$\mathrm{pOH} = -\log(0.045) = 1.35$$

$$\therefore \mathrm{pH} = 14 - \mathrm{pOH} = 14 - 1.35 = 12.65$$

122. Strong reducing behaviour of $\mathrm{H_3PO_2}$ is due to:
(1) Presence of one –OH group and two p – H bonds
(2) High electron gain enthalpy of phosphorus
(3) High oxidation state of phosphorus
(4) Presence of two –OH groups and one p – H bond

Solution: (1) Strong reducing behaviour of $\mathrm{H_3PO_2}$

All oxy-acid of phosphorus which contain P – H bond act as reductant.



Presence of one –OH group and two P – H bonds.

123. The number of structural isomers possible from the molecular formula C_3H_9N is:

(1) 4

(2) 5

(3) 2

(4) 3

Solution: (1)

C_3H_9N : $CH_3-CH_2-CH_2-NH_2$, $CH_3-CH(NH_2)-CH_3$] 1° amine

$CH_3 - CH_2 - NH - CH_3$ } 2° amine

$CH_3-N(CH_3)-CH_3$] 3° amine

124. Which of the following statements is not correct for a nucleophile?

(1) Nucleophile is a Lewis acid

(2) Ammonia is a nucleophile

(3) Nucleophiles attack low e^- density sites

(4) Nucleophiles are not electron seeking

Solution: (1) Reason: Nucleophiles are electron rich species so act as Lewis base.

125. Number of possible isomers for the complex $[Co(en)_2Cl_2]Cl$ will be: (en = ethylene diamine)

(1) 2

(2) 1

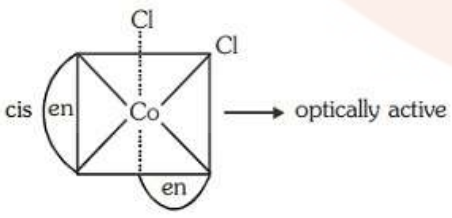
(3) 3

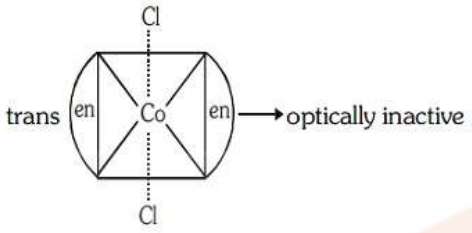
(4) 4

Solution: (3) $[Co(en)_2Cl_2]Cl$

Possible isomers

(i) Geometrical isomers





(ii) In trans form plane of symmetry present, so trans form is optically inactive but cis is optically active.

Total number of stereoisomer = 2 + 1 = 3

126. Which is the correct order of increasing energy of the listed orbitals in the atom of titanium?
(At. No. Z = 22)
(1) 3s 4s 3p 3d
(2) 4s 3s 3p 3d
(3) 3s 3p 3d 4s
(4) 3s 3p 4s 3d

Solution: (4) $\mathrm{Ti}(22) = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$

Order of energy is 3s 3p 4s 3d

127. In an S_N1 reaction on chiral centres, there is:
(1) 100% racemization
(2) Inversion more than retention leading to partial racemization
(3) 100% retention
(4) 100% inversion

Solution: (2) S_N1 reaction gives racemic mixture with slight predominance of that isomer which corresponds to inversion because S_N1 also depends upon the degree of 'shielding' of the front side of the reacting carbon.

128. The vacant space in bcc lattice unit cell is:
(1) 26%
(2) 48%
(3) 23%
(4) 32%

Solution: (4) Packing efficiency in bcc lattice $= 68\%$

$\therefore$Vacant space in bcc lattice $= 100 - 68 = 32\%$

129. The heat of combustion of carbon to CO_2 is -393.5 kJ/mol. The heat released upon formation of 35.2 g of CO_2 from carbon and oxygen gas is:
(1) -315 kJ
(2) $+315$ kJ
(3) -630 kJ
(4) -3.15 kJ

Solution: (1) Formation of CO_2 from carbon and dioxygen gas can be represented as

$C(s) + O_{2(g)} \rightarrow CO_{2(g)}\ ; \Delta_f H = -393.5\ \text{kJ mol}^{-1}$

(1 mole = 44 g)

Heat released on formation of 44 g CO_2

$= -393.5\ \text{kJ mol}^{-1}$

$= \frac{-393.5\ \text{kJ mol}^{-1}}{44\ \text{g}} \times 35.2\ \text{g}$

$= -315\ \text{kJ}$

130. Aqueous solution of which of the following compounds is the best conductor of electric current?

(1) Acetic acid, $C_2H_4O_2$

(2) Hydrochloric acid, HCl

(3) Ammonia, NH_3

(4) Fructose, $C_6H_{12}O_6$

Solution: (2) Aqueous solution of HCl is the best conductor of electric current because HCl is strong acid, so it dissociates completely into ions.

131. The oxidation of benzene by V_2O_5 in the presence of air produces:

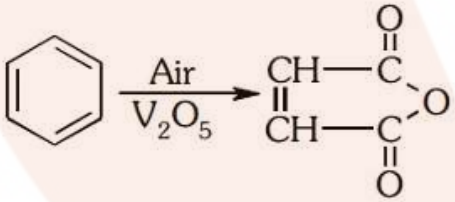
(1) Benzoic anhydride

(2) Maleic anhydride

(3) Benzoic acid

(4) Benzaldehyde

Solution: (2)



Maleic anhydride

132. Reaction of a carbonyl compound with one of the following reagents involves nucleophilic addition followed by elimination of water. The reagent is:

(1) A Grignard reagent

(2) Hydrazine in presence of feebly acidic solution

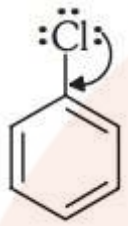
(3) Hydrocyanic acid

(4) Sodium hydrogen sulphite

Solution: (2) With Ammonia derivation carbonyl compounds give addition followed by elimination reaction. Slightly acidic medium will generate a nucleophilic centre for weak base like ammonia derivatives.

133. Method by which Aniline cannot be prepared is:
(1) Hydrolysis of phenylisocyanide with acidic solution
(2) Degradation of benzamide with bromine in alkaline solution
(3) Reduction of nitrobenzene with H_2/Pd in ethanol.
(4) Potassium salt of phthalimide treated with chlorobenzene followed by hydrolysis with aqueous NaOH solution.

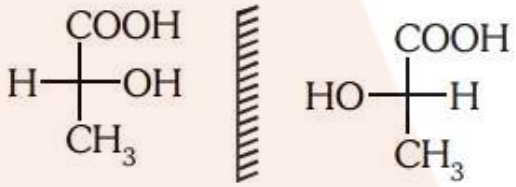
Solution: (4)



Due to resonance C – Cl bond acquires double bond character.

134. Two possible stereo-structures of $CH_3CHOH \cdot COOH$, which are optically active, are called:
(A) Diastereomers
(B) Atropisomers
(C) Enantiomers
(D) Mesomers

Solution: (3)



Both are enantiomers.

135. The correct statement regarding defects in crystalline solids is :
(1) Schottky defects have no effect on the density of crystalline solids
(2) Frenkel defects decrease the density of crystalline solids
(3) Frenkel defect is a dislocation defect
(4) Frenkel defect is found in halides of alkaline metals

Solution: (3) Frenkel defect is a dislocation defect.

Physics

136. The position vector of a particle $\vec{R}$ as a function of time is given by:

$\bar{R} = 4\sin(2\pi t)\,\hat{i} + 4\cos(2\pi t)\hat{j}$

Where R is in meters, t is in seconds and $\hat{i}$ and $\hat{j}$ denote unit vectors along x- and y-directions, respectively. Which one of the following statements is wrong for the motion of particle?

(1) Magnitude of acceleration vector is $\frac{v^2}{R}$, where v is the velocity of particle.

(2) Magnitude of the velocity of particle is 8 meter/second

(3) Patch of the particle is a circle of radius 4 meter.

(4) Acceleration vector is along $-\vec{R}$.

Solution: (2)

$x = 45\text{ m } 2\pi t,$

$y = 4\cos(2\pi\, t)$

Squiring and adding

⇒ Circular motion

$V = \omega = (2\pi)(4) = 8\pi$

So , Ans is (2)

137. The energy of the em waves is of the order of 15 keV. To which part of the spectrum does it belong?

(1) Infra-red rays

(2) Ultraviolet rays

(3) γ-rays

(4) X-rays

Solution: (4)

Wavelength of the ray

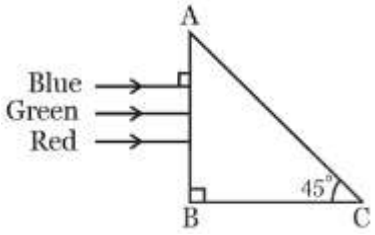
$\lambda = \frac{hc}{E}$

$= 0.826\ \text{Å}$

Since $\lambda < 100\ \text{Å}$

So it is X-ray

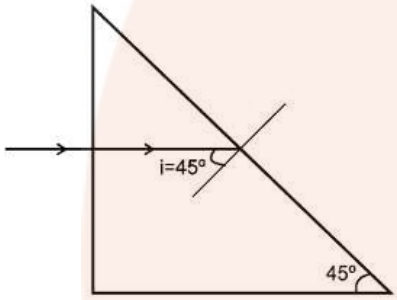
138. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39,1.44 and 1.47 respectively.



The prism will:

(1) Separate all the three colours from one another
(2) Not separate the three colours at all
(3) Separate the red colour part from the green and blue colours
(4) Separate the blue colour part from the red and green colours

Solution: (3)



For TIR $I > I_c$ so $\text{Sin } i > \sin I_c$

$$\text{Sin } 45^o > \frac{1}{\mu} \Rightarrow \mu\sqrt{2} \Rightarrow \mu = 1.414$$

Since μ of green and violet are greater than 1.414 so they will total internal refrected. But red colour will be vetracted.

So Ans. is (3)

139. Two particles A and B move with constant velocities $\vec{v}_1$ and $\vec{v}_2$. At the initial moment their position vectors $\vec{r}_1$ and $\vec{r}_2$ respectively. The condition for particles A and B for their collision is:

(1) $\vec{r}_1 \cdot \vec{v}_1 = \vec{r}_2 \cdot \vec{v}_2$
(2) $\vec{r}_1 \times \vec{v}_1 = \vec{r}_2 \times \vec{v}_2$
(3) $\vec{r}_1 - \vec{r}_2 = \vec{v}_1 - \vec{v}_2$
(4) $\frac{\vec{r}_1 - \vec{r}_2}{|\vec{r}_1 - \vec{r}_2|} = \frac{\vec{v}_2 - \vec{v}_1}{|\vec{v}_2 - \vec{v}_1|}$

Solution: (4)

For two particles to collide, the direction of the relative velocity of one with respect to other should be directed towards the relative position of the other particle

i.e. $\frac{\vec{r}_1 - \vec{r}_2}{|\vec{r}_1 - \vec{r}_2|}$ → direction of relative position of 1 w.r.t..2.

& $\frac{\vec{v}_2-\vec{v}_1}{|\vec{v}_2|-\vec{v}_1} \rightarrow$ direction of velocity of 2 w.r.t.1

So for collision of A & B

$$\frac{\vec{r}_1-\vec{r}_2}{|\vec{r}_1-\vec{r}_2|}=\frac{\vec{v}_2-\vec{v}_1}{|\vec{v}_2-\vec{v}_1|}$$

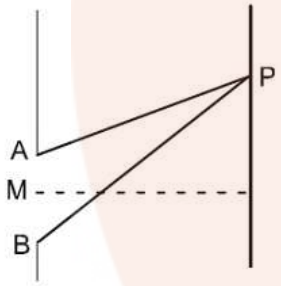
140. At the first minimum adjacent to the central maximum of a single-slit diffraction pattern, the phase difference between the Huygen's wavelet from the edge of the slit and the wavelet from the midpoint of the slit is:

(1) $\frac{\pi}{2}$ radian
(2) π radian
(3) $\frac{\pi}{8}$ radian
(4) $\frac{\pi}{4}$ radian

Solution: (2)

For first minima

$$AP-BP=\lambda$$



$$AP-MP=\frac{\lambda}{2}$$

So phase difference $=\frac{2\pi}{\lambda}\times\frac{\lambda}{2}=\pi$

141. A proton and an alpha particle both enter a region of uniform magnetic field B, moving at right angles to the field B. if the radius of circular orbits for both the particles is equal and the kinetic energy acquired by proton is 1 MeV, the energy acquired by the alpha particle will be:

(1) 0.5 MeV
(2) 1..5 MeV
(3) 1 MeV
(4) 4 MeV

Solution: (3)

$$R=\frac{mV}{qB}=\frac{\sqrt{2m(kE)}}{qB}$$

Since R is same so $\mathrm{KE} \propto \frac{q^2}{m}$

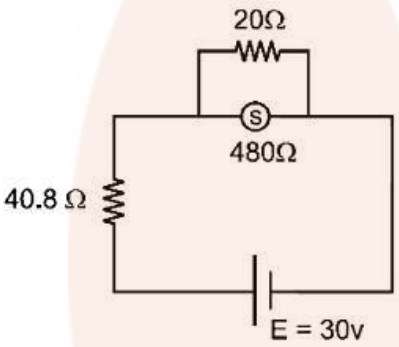
So KE of α particle will be $\frac{(2)^2}{4} = \text{same} = 1\ \mathrm{MeV}$

Ans. is (3)

142. A circuit contains an ammeter, a battery of 30 v and a resistance 40.8 ohm all connected in series. If the ammeter has coil of resistance 480 ohm and a shunt of 20 ohm, the reading in the ammeter will be:

(1) 0.25 A
(2) 2 A
(3) 1 A
(4) 0.5 A

Solution: (4)



Resistance of ammeter $= \frac{480\times20}{480+20} = 19.2\Omega$

$$i = \frac{30}{40.8 + 19.2} = 0.5\ \mathrm{A}$$

Ans. is (4)

143. The value of coefficient of volume expansion of glycerin is $5 \times 10^{-4}\mathrm{K}^{-1}$. The fractional change in the density of glycerin for a rise of $40^{o}\mathrm{C}$ in its temperature is:

(1) 0.020
(2) 0.025
(3) 0.010
(4) 0.015

Solution: (1)

$$\rho = \rho_0(1 - \gamma\Delta t)$$

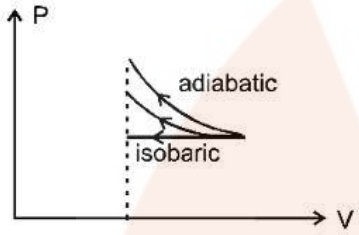
$$\frac{\Delta\rho}{\rho_0} = \gamma\Delta T = (5 \times 10^{-4})(40) = 0.02$$

Ans. is (1)

144. An ideal gas is compressed to half its initial volume by means of several processes. Which of the process results in the maximum work done on the gas?

(1) Isobaric
(2) Isochoric
(3) Isothermal
(4) Adiabatic

Solution: (4)



Since area under the curve is max for adiabatic process so work done on the gas will be max for adiabatic process.

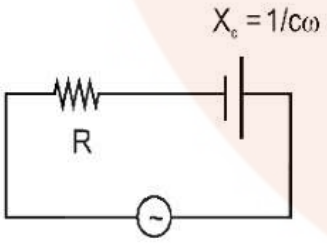
145. A series R-C circuit is connected to an alternating voltage source. Consider two situations:

i. When capacitor is air filled.
ii. When capacitor is mica filled.

Current through resistor is i and voltage across capacitor is V then:

(1) $V_a > V_b$
(2) $i_a > i_b$
(3) $V_a = V_b$
(4) $V_a < V_b$

Solution: (1)



$$i = \frac{v}{\sqrt{R^2 + \left(\frac{1}{c\omega}\right)^2}}$$

$$V_C = \frac{v}{\sqrt{R^2 + \left(\frac{1}{c\omega}\right)^2}} \times \left(\frac{1}{c\omega}\right)$$

$$V_C = \frac{V}{\sqrt{(Rc\omega)^2 + 1}}$$

If we fill a di-electric material

$C \uparrow \Rightarrow V_C \downarrow$

Ans is (1)

146. Light of wavelength 500 nm is incident on a metal with work function 2.258 eV. The de Broglie wavelength of the emitted electron is:

(1) $< 2.8 \times 10^{-9}$ m
(2) $\geq 2.8 \times 10^{-9}$ m
(3) $\leq 2.8 \times 10^{-12}$ m
(4) $< 2.8 \times 10^{-10}$ m

Solution: (2)

$$KE_{max} = \frac{hc}{\lambda} - \Psi$$

$$KE_{max} = \frac{1240}{500} - 2.82$$

$$KE_{max} = 2.48 - 2.28 = 0.2 \text{ eV}$$

$$\lambda_{min} = \frac{h}{\sqrt{2m(KE)_{max}}} = \frac{\frac{20}{3} \times 10^{-34}}{\sqrt{2 \times 9 \times 10^{-31} \times 0.2 \times 1.6 \times 10^{-19}}}$$

$$\lambda_{min} = \frac{25}{9} \times 10^{-9} = 2.80 \times 10^{-9} \text{ nm}$$

So $\lambda \geq 2.8 \times 10^{-9}$ m

Ans. (2)

147. Two metal wires of identical dimensions are connected in series. If v_1 and v_2 are the conductivities of the metal wires respectively, the effective conductivity if the combination is:

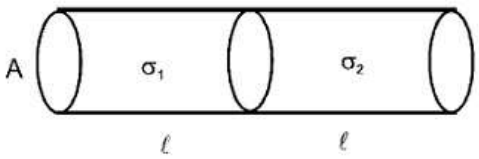
(1) $\frac{\sigma_1+\sigma_2}{2\,\sigma_1\,\sigma_2}$

(2) $\frac{\sigma_1+\sigma_2}{\sigma_1\,\sigma_2}$

(3) $\frac{\sigma_1\,\sigma_2}{\sigma_1+\sigma_2}$

(4) $\frac{2\,\sigma_1\,\sigma_2}{\sigma_1+\sigma_2}$

Solution: (4)



$$R_{ec} = \frac{\ell}{\sigma_1 A} + \frac{\ell}{\sigma_1 A} = \frac{\ell_{eq}}{\sigma_{eq} A_{eq}}$$

$$\frac{2\ell}{\sigma_{eq} A} = \frac{\ell}{A}\left(\frac{\sigma_1 + \sigma_2}{\sigma_1 \sigma_2}\right)$$

$$\sigma_{eq} = \frac{2\sigma_1 \sigma_2}{\sigma_1 \sigma_2}$$

Ans. (4)

148. An automobile moves on a road with a speed of $54\ \text{km h}^{-1}$. The radius of its wheels is 0.45 m and the moment of inertia of the wheel about its axis of rotation is $3\ \text{kg m}^2$. If the vehicle is brought to rest in 15s, the magnitude of average torque transmitted by its brakes to the wheel is:

(1) $8.58\ \text{kg m}^2\text{s}^{-2}$
(2) $10.86\ \text{kg m}^2\ \text{s}^{-2}$
(3) $2.86\ \text{kg m}^2\ \text{s}^{-2}$
(4) $6.66\ \text{kg m}^2\text{s}^{-2}$

Solution: (4)

$$\omega_i = \frac{15}{0.45} = \frac{100}{3}\ \omega_f = 0$$

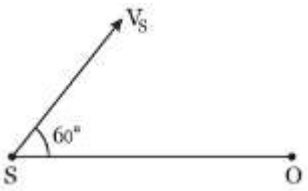
$$\omega_f = \omega_i + \alpha t$$

$$0 = \frac{100}{3} + (-\alpha)(15)$$

$$\alpha = \frac{100}{45}$$

$$\tau = (I)(\alpha) = 3 \times \frac{100}{45} = 6.66\ \text{N. M}$$

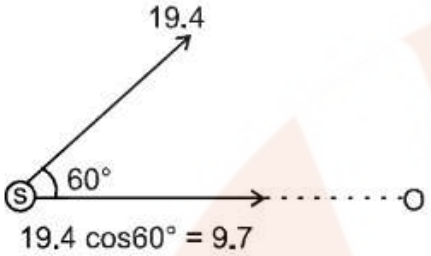
149. A source of sound S emitting waves of frequency 100 Hz and an observer O are located at some distance from each other. The source is moving with a speed of $19.4\ \text{ms}^{-1}$ at an angle of 60^o with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer (velocity of sound in air $330\ \text{ms}^{-1}$), is:



(1) 103 Hz

(2) 106 Hz
(3) 97 Hz
(4) 100 Hz

Solution: (1)



$$t^1 = f_0\left(\frac{v - v}{v - v_s}\right)$$

$$f^1 = 100\left(\frac{v - 0}{v - (+9.7)}\right)$$

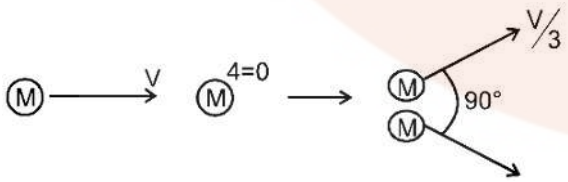
$$f^1 = 100\frac{v}{v\left(1 - \frac{9.7}{v}\right)}$$

$$f^1 = 100\left(1 + \frac{3.7}{330}\right) = 103\text{Hz}$$

150. On a frictionless surfaces, a block of mass M moving at speed v collides elastically with another block of same mass M which is initially at rest. After collision the first block moves at an angle θ to its initial direction and has a speed $\frac{v}{3}$. The second block's speed after the collision is:

(1) $\frac{3}{4}v$
(2) $\frac{3}{\sqrt{2}}v$
(3) $\frac{\sqrt{3}}{2}v$
(4) $\frac{2\sqrt{2}}{3}v$

Solution: (4)

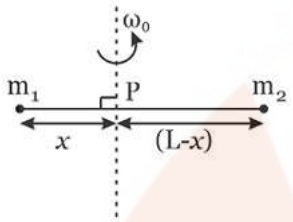


$$\vec{P_i} = \vec{P_f}$$

$$\Rightarrow |P_i| = |P_f| \Rightarrow \sqrt{\left(m\frac{V}{3}\right)^2 + (mV_2)^2}$$

$$V_2 = \frac{2\sqrt{2}}{3}V$$

151. Point masses m_1 and m_2 are placed at the opposite ends of rigid rod of length L, and negligible mass. The rod is to be set rotating about an axis perpendicular to it. The position of point P on this rod through which the axis should pass so that the work required to set the rod rotating with angular velocity ω_0 is minimum, is given by:



(1) $x = \frac{m_1}{m_2}L$

(2) $x = \frac{m_2}{m_1}L$

(3) $x = \frac{m_2 L}{m_1+m_2}$

(4) $x = \frac{m_1 L}{m_1+m_2}$

Solution: (3)

$$K.E. = \frac{1}{2}I\,\omega^2$$

I is min. about the centre of mass

So, $(m_1)(x) = (m_2)(L-x)$

$$x = \frac{m_2 L}{m_1 + m_2}$$

152. A ball is thrown vertically downwards from a height of 20 m with an initial velocity v_0. It collides with the ground, loses 50 percent of its energy in collision and rebounds to the same height. The initial velocity v_0 is: (Take $g = 10\ ms^{-2}$)

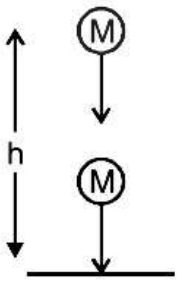
(1) $20\ ms^{-1}$

(2) $28\ ms^{-1}$

(3) $10\ ms^{-1}$

(4) $14\ ms^{-1}$

Solution: (1)



$$\frac{KE_f}{KE_i} = \frac{1}{2}$$

$$\frac{V_f}{V_i} = \frac{1}{\sqrt{2}}$$

$$\frac{\sqrt{2gh}}{\sqrt{V_0^2 + 2gh}} = \frac{1}{\sqrt{2}}$$

$V_0 = 20$ m/sec

153. A nucleus of uranium decays at rest into nuclei of thorium and helium. Then:

(1) The helium nucleus has less momentum then the thorium nucleus
(2) The helium nucleus has more momentum than the thorium nucleus
(3) The helium nucleus has less kinetic energy than the thorium nucleus
(4) The helium nucleus has more kinetic energy than the thorium nucleus

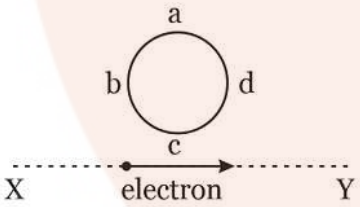
Solution: (4)

$$U \rightarrow Th + \alpha$$

$$KE_{Th} = \frac{P^2}{2m_{Th}}, KE_\alpha = \frac{P^2}{2m_\alpha}$$

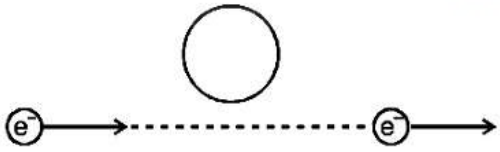
Since m_α is less so KE_α will be mone.

154. An electron moves on a straight line path XY as shown. The abcd is a coil adjacent to the path of electron. What will be the direction of current, if any, induced in the coil?



(1) adcb
(2) The current will reverse its direction as the electron goes past the coil
(3) No current induced
(4) abcd

Solution: (2)



When e^- comes closer the induced current will be anticlockwise

When e^- comes farther induced current will be clockwise.

155. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then, its time period of vibration will be:

(1) $\frac{\alpha}{\beta}$

(2) $\frac{\beta^2}{\alpha}$

(3) $\frac{2\pi\beta}{\alpha}$

(4) $\frac{\beta^2}{\alpha^2}$

Solution: (3)

$$\omega^2 A = \alpha$$

$$\omega A = \beta$$

$$\Rightarrow \omega = \frac{\alpha}{\beta}$$

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

156. Two slits in Young's experiment have widths in the ratio 1 : 25. The ratio of intensity at the maxima and minima in the interference pattern, $\frac{I_{max}}{I_{min}}$ is:

(1) $\frac{121}{49}$

(2) $\frac{49}{121}$

(3) $\frac{4}{9}$

(4) $\frac{9}{4}$

Solution: (4)

$$\frac{I_1}{I_2} = \frac{25}{1} \Rightarrow \frac{A_1}{A_2} = \frac{5}{1}$$

$$\frac{A_{max}}{A_{min}} = \frac{5+1}{5-1} = \frac{6}{4} = \frac{3}{2}$$

$$\frac{I_{max}}{I_{min}} = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

157. If potential (in volts) in a region is expressed as $V(x, y, z) = 6xy - y + 2yz$, the electric field (in N/C) at point (1, 1, 0) is:

(1) $-\left(6\hat{i} + 5\hat{j} + 2\hat{k}\right)$

(2) $-\left(2\hat{i} + 3\hat{j} + \hat{k}\right)$

(3) $-\left(6\hat{i} + 9\hat{j} + \hat{k}\right)$

(4) $-\left(3\hat{i} + 5\hat{j} + 3\hat{k}\right)$

Solution: (1)

$$V = 6xy - y + 24z$$

$$\bar{E} = \left(\frac{\partial V}{\partial x}\hat{i} + \frac{\partial V}{\partial y}\hat{j}\frac{\partial V}{\partial z}\hat{k}\right)$$

$$\bar{E} = \left[(6y)\hat{i} + (6x - 1 + 2z)\hat{j} + (2y)\hat{k}\right]$$

$$\bar{E} = -\left(6\hat{i} + 5\hat{j} + 2\hat{k}\right)$$

$(1, 1, 0)$

158. A parallel plate air capacitor has capacity 'C', distance of separation between plates is 'd' and potential difference 'V' is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is:

(1) $\frac{CV^2}{2d}$

(2) $\frac{CV^2}{d}$

(3) $\frac{C^2V^2}{2\,d^2}$

(4) $\frac{C^2V^2}{2\,d}$

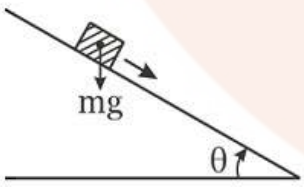
Solution: (1)

Attraction between the plates

$F = \frac{q^2}{2A\varepsilon_0}$ where $q - CV$ and $C = \frac{\varepsilon_0 A}{d}$

$$F = \frac{C^2V^2}{2Cd} = \frac{CV^2}{2d}$$

159. A plank with a box on it at one end is gradually raised about the other end. As the angle of inclination with the horizontal reaches 30^o, the box starts to slip and slides 4.0 m down the plank in 4.0 s. The coefficients of static and kinetic friction between the box and the plank will be, respectively:



(1) 0.6 and 0.5
(2) 0.5 and 0.6
(3) 0.4 and 0.3
(4) 0.6 and 0.6

Solution: (1)

$$\mu_s = \tan 30^o = \frac{1}{\sqrt{3}} = 0.5$$

$\mu_s = 0.57 = 0.6$

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

$4 = \frac{1}{2}a(4)^2 \Rightarrow a = \frac{1}{2} = 0.5$

$a = g\sin\theta - \mu_k(g)\cos\theta$

$\Rightarrow \mu_K = \frac{0.9}{\sqrt{3}} = 0.5$

160. In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is:

(1) $\frac{9}{4}$
(2) $\frac{27}{5}$
(3) $\frac{5}{27}$
(4) $\frac{4}{9}$

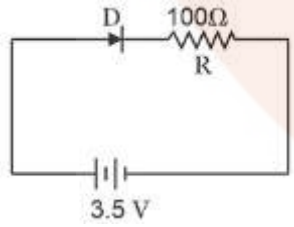
Solution: (3)

$\frac{1}{\lambda_1} = R_e\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

$\frac{1}{\lambda_2} = R_e\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\frac{\lambda_1}{\lambda_2} = \frac{5}{27}$

161. In the given figure, a diode D is connected to an external resistance $R = 100\ \Omega$ and an e.m.f. of 3.5 V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be:



(1) 40 mA
(2) 20 mA
(3) 35 mA
(4) 30 mA

Solution: (4)

$\text{Current} = \frac{(3.5 - 0.5)}{100}\text{A}$

$= \frac{3}{100} \text{A} = 30 \text{ mA}$

162. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth. Then,

(1) The total mechanical energy of S varies periodically with time
(2) The linear momentum of S remains constant is magnitude
(3) The acceleration of S is always directed towards the centre of the earth
(4) The angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant

Solution: (3)

The gravitation force on the satellite will be aiming toward the centre of earth so acceleration of the satellite will also be aiming toward the centre of earth.

163. A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. The value of α for which angular momentum about origin is conserved is:

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

Solution: (4)

If $\vec{L} =$ constant then $\vec{\tau} = 0$

So $\vec{r} \times \vec{F} = 0 \Rightarrow \vec{F}$ should be parallel to $\vec{r}$ so coefficient should be in same ratio. So $\frac{\alpha}{2} = \frac{3}{-6} = \frac{6}{-12}$

So $\alpha = -1$

Ans (4)

164. A potentiometer wire of length L and a resistance r are connected in series with a battery of e.m.f. E_0 and a resistance r_1. An unknown e.m.f. E is balanced at a length l of the potentiometer wire. The e.m.f. E will be given by:

(1) $\frac{E_0 r}{(r+r_1)} \cdot \frac{l}{L}$
(2) $\frac{E_0 l}{L}$
(3) $\frac{LE_0 r}{(r+r_1)l}$
(4) $\frac{LE_0 r}{l\, r_1}$

Solution: (1)

$K =$ potential gradient $= \left(\frac{E_0 r}{r+r_1}\right)\frac{1}{L}$

So $E = K\ell = \frac{E_0 r \ell}{(r+r_1)L}$

165. 4.0 g of a gas occupies 22.4 liters at NTP. The specific heat capacity of the gas at constant volume is $5.0\ \mathrm{JK^{-1}\ mol^{-1}}$. If the speed of sound in this gas at NTP is $952\ \mathrm{ms^{-1}}$, then the heat capacity at constant pressure is

(Take gas constant $\mathrm{R} = 8.3\ \mathrm{JK^{-1}\ mol^{-1}}$)

(1) $7.5\ \mathrm{JK^{-1}\ mol^{-1}}$
(2) $7.0\ \mathrm{JK^{-1}\ mol^{-1}}$
(3) $8.5\ \mathrm{JK^{-1}\ mol^{-1}}$
(4) $8.0\ \mathrm{JK^{-1}\ mol^{-1}}$

Solution: (4)

No. of mole of gas = 1 so molar mass = 4g/mole

$$\mathrm{V} = \sqrt{\frac{\gamma \mathrm{RT}}{\mathrm{m}}} \Rightarrow 952 \times 952 = \frac{\gamma \times 3.3 \times 273}{4 \times 10^{-3}} \Rightarrow \gamma = 1.6 = \frac{16}{10} = \frac{8}{5}$$

166. Two stones of masses ma and 2 m are whirled in horizontal circles, the heavier one in a radius $\frac{\mathrm{r}}{2}$ and the lighter one in radius r. the tangential speed of lighter stone is n times that of the value of heavier stone when they experience same centripetal forces. The value of n is:

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

Solution: (4)

$$\mathrm{F_C} = \frac{\mathrm{mv_1^2}}{\mathrm{r}} = \frac{2\mathrm{mv_2^2}}{\left(\frac{\mathrm{r}}{2}\right)} = \frac{4\mathrm{mv_2^2}}{\mathrm{r}}$$

So $\mathrm{V_1} = 2\mathrm{V_2}$

167. A remote-sensing satellite of earth revolves in a circular orbit at a height of 0.25×10^6 m above the surface of earth. If earth's radius is 6.38×10^6 m and $\mathrm{g} = 9.8\ \mathrm{ms^{-2}}$, then the orbital speed of the satellite is:

(1) $8.56\ \mathrm{km\ s^{-1}}$
(2) $9.13\ \mathrm{km\ s^{-1}}$
(3) $6.67\ \mathrm{km\ s^{-1}}$
(4) $7.76\ \mathrm{km\ s^{-1}}$

Solution: (4)

$$\mathrm{V_0} = \sqrt{\frac{\mathrm{GM}}{\mathrm{r}}} = \sqrt{\frac{\mathrm{GM}}{\mathrm{R^2}} \cdot \frac{\mathrm{R^2}}{\mathrm{r}}}$$

$= \sqrt{\frac{9.8 \times 6.38 \times 6.38}{6.63 \times 10^6}} = \sqrt{60 \times 10^6}$ m/sec

$= 7.76$ km/sec

168. A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequency for this string is:

(1) 205 Hz
(2) 10.5 Hz
(3) 105 Hz
(4) 155 Hz

Solution: (3)

Two consecutive resonant frequencies for a string fixed at both ends will be

$$\frac{nv}{2\ell} \text{ and } \frac{(n+1)v}{2\ell}$$

$$\Rightarrow \quad \frac{(n+1)v}{2\ell} - \frac{nv}{2\ell} = 420 - 315$$

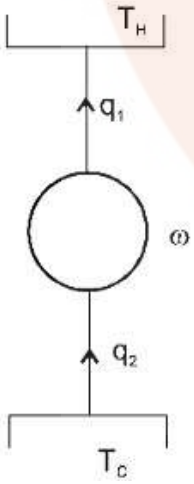
$$\frac{v}{2\ell} = 105 \text{ Hz}$$

Which is the minimum resonant frequency.

169. The coefficient of performance of a refrigerator is 5. If the temperature inside freezer is $-20^{o}C$, the temperature of the surrounding to which is rejects heat is:

(1) $41^{o}C$
(2) $11^{o}C$
(3) $21^{o}C$
(4) $31^{o}C$

Solution: (4)



$$\text{cop} = \frac{q_1}{w} = \frac{q_2}{q_1 - q_2} = \frac{T_c}{T_H - T_C} = 5$$

$$T_C = 5T_H - 5T_c$$

$$6T_c = 5T_H$$

$$T_H = \frac{6}{5} \times 253k = 303.6k = 30.6^oC = 31^oC$$

170. Water rises to a height 'h' in capillary tube. If the length of capillary tube above the surface of water is made less than 'h', then:

(1) Water rises upto the top of capillary tube and stays there without overflowing
(2) Water rises upto a point a little below the top and stays there
(3) Water does not rise at all
(4) Water rises upto the tip of capillary tube and then starts overflowing like a fountain

Solution: (1)

Water will not overflow but will change its radius of curvature.

171. Two vessels separately contain two ideal gases A and B at the same temperature, the pressure of a being twice that of B. Under such conditions, the density of A is found to be 1.5 times the density if B. The ratio of molecular weight of A and B is:

(1) $\frac{3}{4}$
(2) 2
(3) $\frac{1}{2}$
(4) $\frac{2}{3}$

Solution: (1)

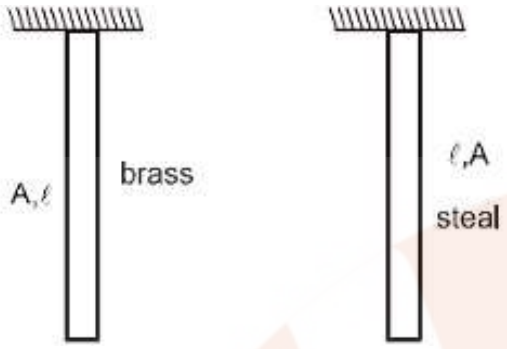
$$P_A = \frac{\rho_A M_A}{RT}, P_B = \frac{\rho_B M_B}{RT} = \frac{3}{2} \Rightarrow \frac{P_A}{P_B} = \frac{\rho_A}{\rho_B}\frac{M_A}{M_B} = 2\frac{M_A}{M_B} = \frac{3}{2}$$

So, $\frac{M_A}{M_B} = \frac{3}{4}$

172. The Young's modulus of steel is twice that of brass. Two wires of same length and of same area of cross section, one of steel and another of brass are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weights added to the steel and brass wires must be in the ration of:

(1) 2 : 1
(2) 4 : 1
(3) 1 : 1
(4) 1 : 2

Solution: (1)



$$Y = \frac{W}{A} \cdot \frac{\ell}{\Delta\ell}$$

So $\Delta\ell = \frac{W\ell}{AY}$

$\Delta e_1 = \Delta e_2$ $\qquad \frac{w_1\ell}{AY_1} = \frac{w_2\ell}{AY_2}$

$$\frac{w_1}{w_2} = \frac{Y_1}{Y_2} = 2$$

173. The input signal given to a CE amplifier having a voltage gain of 150 is $V_i = 2\cos\left(15t + \frac{\pi}{3}\right)$. The corresponding output signal will be:

(1) $75\cos\left(15t + \frac{2\pi}{3}\right)$

(2) $2\cos\left(15t + \frac{5\pi}{6}\right)$

(3) $300\cos\left(15t + \frac{4\pi}{3}\right)$

(4) $300\cos\left(15t + \frac{\pi}{3}\right)$

Solution: (3)

CE amplifier causes phase difference of $\pi(= 180^o)$ so $V_{out} = 300\cos\left(15t + \frac{\pi}{3} + \pi\right)$

174. In an astronomical telescope in normal adjustment a straight black line of the length L is drawn on inside part of objective lens. The eye-piece forms a real image of this line. The length of this image is I. The magnification of the telescope is:

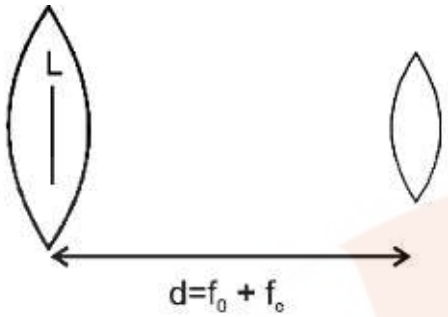
(1) $\frac{L}{I} - 1$

(2) $\frac{L+I}{L-I}$

(3) $\frac{L}{I}$

(4) $\frac{L}{I} + 1$

Solution: (3)



Magnification by eyepiece

$$m = \frac{f}{f+u}$$

$$-\frac{I}{L} = \frac{f_e}{f_e + (-(f_0 + f_e)}$$

$$\Rightarrow \quad \frac{I}{L} = \frac{f_e}{f_0}$$

$$m.p. = \frac{f_0}{f_e} = \frac{L}{I}$$

175. The heart of a man pumps 5 litres of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be $13.6 \times 10^3 \ \text{kg/m}^3$ and $g = 10 \ \text{m/s}^2$ then the power of heart in watt is:

(1) 2.35
(2) 3.0
(3) 1.50
(4) 1.70

Solution: (4)

Power $= \vec{F} . \vec{V} = PA\vec{V} = \rho gh \, AV$

$$= 13.6 \times 10^3 \times 10 \times 150 \times 10^{-3} \times 0.5 \times 10^{-3} / 60 \text{ watt}$$

$$= \frac{102}{60} \text{ watt} = 1.70 \text{ watt.}$$

176. If dimensions of critical velocity v_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^z]$, where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by:

(1) $-1, -1, 1$
(2) $-1, -1, -1$
(3) $1, 1, 1$
(4) $1, -1, -1$

Solution: (4)

$$V_c = \eta^x \rho^y r^z$$

Critical velocity is given by $V_c = \frac{R\eta}{2\rho r}$

So, $x = 1$

$y = -1$

$z = -1$

177. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function of the surface of the material is:

(h = Planck's constant, c= speed of light)

(1) $\frac{hc}{\lambda}$
(2) $\frac{2hc}{\lambda}$
(3) $\frac{hc}{3\lambda}$
(4) $\frac{hc}{2\lambda}$

Solution: (4)

$$k_1 = \frac{hc}{\lambda} - \psi$$

$$k_2 = 3k_1 = \frac{2hc}{\lambda} - \psi = \frac{3hc}{\lambda} - 3\psi$$

So $2\psi = \frac{hc}{\lambda}$ So $\psi = \frac{hc}{2\lambda}$

178. The cylindrical tube of a spray pump has radius R, one end of which has n fine holes, each of radius r. If the speed of the liquid in the tube is V, the speed of the ejection of the liquid through the holes is :

(1) $\frac{VR^2}{nr^2}$
(2) $\frac{VR^2}{n^3r^2}$
(3) $\frac{V^2R}{nr}$
(4) $\frac{VR^2}{n^2r^2}$

Solution: (1)

Volume inflow rate = volume anflow rate

$$\pi R^2 V = n\pi r^2 \quad \Rightarrow \quad v = \frac{\pi R^2 V}{n\pi r^2} = \frac{VR^2}{\mathrm{nr}^2}$$

179. If vectors $\vec{A} = \cos\omega t\, i\hat{i} + \sin\omega t\, \hat{j}$ and $\vec{B} = \cos\frac{\omega t}{2}\hat{i} + \sin\frac{\omega t}{2}\hat{j}$ are functions of times, then the value of t at which they are orthogonal to each other is:

(1) $t = \frac{\pi}{2\omega}$
(2) $t = \frac{\pi}{\omega}$
(3) $t = 0$
(4) $t = \frac{\pi}{4\omega}$

Solution: (2)

$$\bar{A} = \cos wt\, \hat{i} + \sin wt\, \hat{j}$$

$$\bar{B} = \cos\frac{wt}{2}\, \hat{i} + \sin\frac{wt}{2}\, \hat{j}$$

for $\vec{A} \cdot \vec{B} = 0$

$$\bar{A} \cdot \bar{B} = 0 = \cos wt. \cos\frac{wt}{2} + \sin wt. \sin\frac{wt}{2}$$

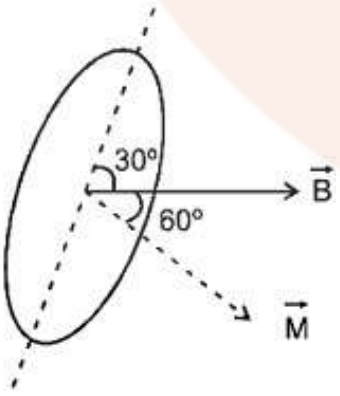
$$= \cos\left(wt - \frac{wt}{2}\right) = \cos\left(\frac{wt}{2}\right)$$

So $\frac{wt}{2} = \frac{\pi}{2} \quad \Rightarrow \quad t = \frac{\pi}{w}$

180. A rectangular coil of length 0.12 m and width 0.1 m having 50 turns of wire is suspended vertically in a uniform magnetic field of strength 0.2 Weber/m^2. The coil carries a current of 2A. if the plane of the coil is inclined at an angle of 30^o with the direction of the field, the torque required to keep coil in stable equilibrium will be:

(1) 0.20 Nm
(2) 0.24 Nm
(3) 0.12 Nm
(4) 0.15 Nm

Solution: (1)



$$\vec{\tau} = \vec{M} \times \bar{B} = MB\sin 60^o$$

$$= Ni\, AB\sin 60^o$$

$$50 \times 2 \times 0.12 \times 0.1 \times 0.2 \times \frac{\sqrt{3}}{2}$$

$$= 12\sqrt{3} \times 10^{-2}\ \text{Nm} = 0.20748\ \text{Nm}$$