NEET-UG EXAMINATION PAPER-2015

(Solved)

Time allowed : 3 hours | Maximum Marks : 720

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **180 questions.** All questions are **compulsory.**

ii. This question paper is divided into **1 sections.**

iii. **Section A** – questions number **1 to 180** are multiple choice questions

iv. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

v. Use of calculator is NOT allowed.

Section A

Question 1. In his classic experiments on sea plants, Mendel did not use

[4 Marks]

(A) Pod length

(B) Seed shape

(C) Flower position

(D) Seed colour

Explanation: Mendel did not use pod length for his experiment.

Question 2. Which one of the following is not applicable to RNA?

[4 Marks]

(A) Heterocyclic nitrogenous bases

(B) 5'phosphoryl and 3' hydroxyl ends

(C) Complementary base pairing

(D) Chargaff's rule

Explanation: Chargaff's rule is not applicable to RNA

Question 3. Male gametophyte in angiosperms produces:

[4 Marks]

(A) Single sperm and two vegetative cells

(B) Single sperm and vegetative cell

(C) Two sperms and a vegetative cell

(D) Three sperms

Explanation: Two sperms and a vegetative cell are produced by male gametophyte in angiosperms.

Question 4. Which of the following are not membrane-bound?

[4 Marks]

(A) Ribosomes

(B) Lysosomes

(C) Mesosomes

(D) Vacuoles

Explanation: Ribosomes are not membrane-bound cell organelle.

Question 5. The chitinous exoskeleton of arthropods is formed by the polymerisation of:

[4 Marks]

(A) lipoglycans

(B) D-glucosamine

(C) N-acetyl glucosamine

(D) Keratin sulphate and chondroitin sulphate

Explanation: The chitinous exoskeleton of arthropods is formed by the polymerisation of N-acetyl glucosamine.

Question 6. Among china rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, how many plants have superior ovary?

[4 Marks]

(A) Six

(B) Three

(C) Five

(D) Four

Explanation: Superior ovary is found in china rose, mustard, brinjal, potato, onion and tulip. Guava and cucumber have inferior ovary.

Question 7. The function of the gap junction is to

[4 Marks]

(A) separate two cells from each other.

(B) stop substance from leading across a tissue

(C) facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules.

(D) stop substance from leading across a tissue

Explanation: The function of the gap junction is to facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules.

Question 8. Which one of the following immunoglobulins does constitute the largest percentage in human milk?

[4 Marks]

(A) IgM

(B) IgA

(C) IgG

(D) IgD

Explanation: Colostrum contains high levels of IgA, which gives passive immunity to foetus.

Question 9. In mammalian eye, the 'fovea' is the center of the visual field, where:

[4 Marks]

(A) the optic nerve leaves the eye

(B) only rods are present

(C) high density of cones occur, but has no rods.

(D) more rods than cones are found

Explanation: Fovea centralis is the most sensitive part of retina. It has high density of cones, but rods are not found.

Question 10.

Doctors use stethoscope to hear the sounds produced during each cardiac cycle. The second sound is heard when:

[4 Marks]

(A) AV valves open up

(B) Semilunar valves close down after the blood flows into vessels from ventricles

(C) Semilunar valves close down after the blood flows into vessels from ventricles

(D) Ventricular wail vibrate due to gushing in of blood from atria

Explanation:

The second sound heard by doctors using stethoscope occurs when semilunar valves close down after the blood flows into vessels from ventricles.

Question 11. Coconut water from a tender coconut is

[4 Marks]

(A) Free nuclear endosperm

(B) Degenerated nucellus

(C) Immature embryo

(D) Innermost layers of the seed coar

Explanation: Coconut water is the free nuclear endosperm which is used by us.

Question 12.

The cutting of DNA at specific locations became possible with the discovery of

[4 Marks]

(A) Restriction enzymes

(B) Ligases

(C) Selectable markers

(D) Probes

Explanation:

Restriction enzymes are used to cut DNA at specific locations.

Question 13. Which of the following structures is not found in a prokaryotic cell?

[4 Marks]

(A) Mesosome

(B) Ribosome

(C) Plasma membrane

(D) Nuclear envelope

Explanation: Nuclear envelope is not found in a prokaryotic cell.

Question 14.

Choose the correct option for the following events of meiosis in correct sequence:

(A) Crossing over

(B) Synapsis

(C) Terminalisation of chiasmata

(D) Disappearance of nucleolus

[4 Marks]

(A) A → B → D → C

(B) D → C → B → A

(C) A → B → C → D

(D) B → A → C → D

Explanation:

Synapsis → Crossing over → Terminalisation of chiasmata → Disappearance of nucleolus.

Question 15. A column of water within xylem vessels of tall trees does not break under its weight because

[4 Marks]

(A) Tensile strength of water

(B) Positive root pressure

(C) Lignification of xylem vessels

(D) Dissolved sugars in water

Explanation: Due to tensile strength of water, a column of water within xylem vessels of tall trees does not break under its weight.

Question 16. The imperfect fungi which are decomposer of litter and help in mineral cycling belong to:

[4 Marks]

(A) Phycomycetes

(B) Basidiomycetes

(C) Deuteromycetes

(D) Ascomycetes

Explanation: Class Deuteromycetes contains imperfect fungi which play role in decomposition of organic wastes.

Question 17. The structures that help some bacteria to attach to rocks and / or host tissues are:

[4 Marks]

(A) Mesosomes

(B) Fimbriae

(C) Holdfast

(D) Holdfast

Explanation: Fimbriae assist some bacteria to get attachment with rocks or host body to get establishment and nutrition.

Question 18. The DNA molecule to which the gene of interest is integrated for cloning is called:

[4 Marks]

(A) Template

(B) Vector

(C) Carrier

(D) Transformer

Explanation: A vector is a DNA molecule which is used as a vehicle to carry the gene of interest to another cell.

Question 19. Pick up the wrong statement

[4 Marks]

(A) Protista have photosynthetic and heterotrophic modes of nutrition

(B) Some fungi are edible

(C) Nuclear membrane is present Monera

(D) Cell wall is absent in Animalia

Explanation: The kingdom Monera possesses unicellular organisms (e.g., bacteria) having no nuclear membrane.

Question 20. Metagenesis refers to:

[4 Marks]

(A) Alteration of generation between asexual and sexual phases of an organism

(B) Occurrence of a drastic change in form during post-embryonic development

(C) Presence of a segmented body and parthenogenetic mode of reproduction

(D) Presence of different morphic forms

Explanation: Metagenesis is defined as alternation of generation found in phylum Cnidaria (e.g., Obelia). In this phenomenon one generation of an organism reproduces asexually, followed by a sexually reproducing generation.

Question 21. Which of the following events is not associated with ovulation in human female?

[4 Marks]

(A) Full development of Graffin follicle

(B) Release of secondary oocyte

(C) LH surge

(D) Decrease in estradiol

Explanation: In human female, during ovulation, LH surge takes place due to hypersecretion of estrogen, which induces positive feedback to anterior pituitary for secretion of LH.

Question 22. Which of the following joints would allow no movement?

[4 Marks]

(A) Cartilaginous joint

(B) Synovial joint

(C) Synovial joint

(D) Fibrous joint

Explanation: Fibrous joint is an attachment between bones, being held together by fibrous connective tissue. For example—suture between skull bones.

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

[4 Marks]

(1)	*Sacharomyces cerevisiae*	**(i)**	Production of immunosuppressive agents
(2)	*Monascus Purpureus*	**(ii)**	Ripening of Swiss cheese
(3)	*Trichoderma polysporum*	**(iii)**	Commercial production of ethanol
(4)	*Propionibacterium sharmanii*	**(iv)**	Production of blood cholesterol lowering agents

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

(A) A

(B) B

(C) C

(D) D

Explanation: a-(iii), b-(iv), c-(i), d-(ii)

Question 24. The UN Conference of Parties on climate change in the year 2012 was held at:

[4 Marks]

(A) Lima

(B) Doha

(C) Warsaw

(D) Durban

Explanation: This conference occurred from 20 Nov to 8 December, 2012 to extend the life of Kyoto Protocol at Doha in Qatar.

Question 25. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidences?

[4 Marks]

(A) Serum albumins

(B) Serum globulins

(C) Haemocytes

(D) Fibrinogen in plasma

Explanation: Serum globulins test provides confirmatory evidence by measuring the deficiency of antibodies (γ-globulin) in a person.

Question 26.

Chromatophores take part in:

[4 Marks]

(A) Movement

(B) Photosynthesis

(C) Growth

(D) Respiration

Explanation:

Chromatophores play an important role in the process of photosynthesis. They contain pigments and are found in blue-green algae.

Question 27. Acid rain is caused by increase in the atmospheric concentration of:

[4 Marks]

(A) SO_3 and CO

(B) CO_2 and CO

(C) O_3 and dust

(D) SO_2 and NO_2

Explanation: 60–70% SO_2 and 20–30% NO_2 contribute to acid rain.

Question 28. During ecological succession:

[4 Marks]

(A) The numbers and types of animals remain constant.

(B) The establishment of a new biotic community is very fast in its primary phase.

(C) The changes lead to a community that is in near equilibrium with the environment and is called pioneer community.

(D) The gradual and predictable change in species composition occurs in a given area.

Explanation: The gradual and predictable change in the composition of species takes place in a given area during ecological succession.

Question 29. The oxygen evolved during photosynthesis comes from water molecules. Which one of the following pairs of elements is involved in this reaction?

[4 Marks]

(A) Magnesium and Molybdenum

(B) Manganese and Potassium

(C) Magnesium and Chlorine

(D) Manganese and Chlorine

Explanation: During photosynthesis, photolysis of water is induced by Mn^{++} and Cl^{-} ions.

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

[4 Marks]

Mode of reproduction	Example
(a) Rhizome	Banana
(b) Binary fission	*Sargassum*
(c) Conidia	*Penicillium*
(d) Offset	Water hyacinth

(A) A

(B) B

(C) D

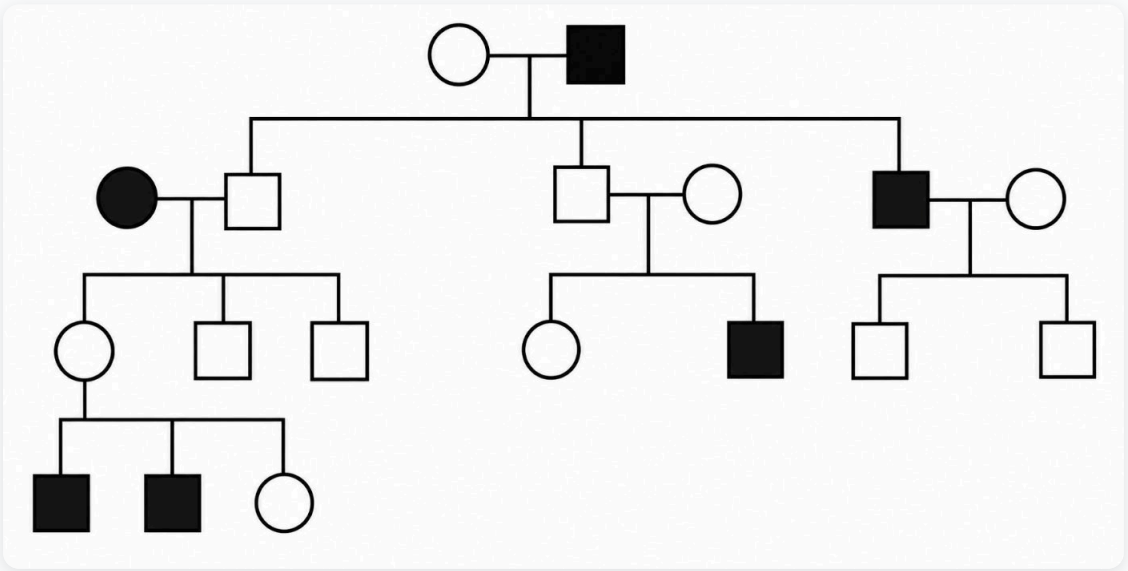
(D) C

Explanation: Binary fission usually takes place in Amoeba, Paramecium and Euglena.

Question 31.

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

[4 Marks]



(A) Autosomal dominant

(B) X-linked dominant

(C) Autosomal recessive

(D) X- linked recessive

Explanation:

Autosomal recessive is a type of disorder in which two copies of an abnormal gene must be found for the disease in the affected person.

Question 32. Which one of the following animals has two separate circulatory pathways?

[4 Marks]

(A) Lizard

(B) Whale

(C) Shark

(D) Frog

Explanation: Whale is a mammal. It has a four-chambered heart having two atria and two ventricles. Oxygenated and deoxygenated blood flow in separate circulatory pathways.

Question 33.

Flowers are unisexual in:

[4 Marks]

(A) Pea

(B) Onion

(C) Cucumber

(D) China rose

Explanation:

The flowers of cucumber are unisexual; it means they have only male flowers or only female flowers.

Question 34. Which one of the following fruits is parthenocarpic?

[4 Marks]

(A) Apple

(B) Jackfruit

(C) Banana

(D) Brinjal

Explanation: Parthenocarpic fruits (e.g., banana) are produced without fertilization of ovule.

Question 35. A pleiotropic gene:

[4 Marks]

(A) is a gene evolved during Pliocene.

(B) controls a trait only in combination with another gene.

(C) is expressed only in primitive plants.

(D) controls multiple traits in an individual.

Explanation: A pleiotropic gene regulates multiple traits (characteristics) in an individual.

Question 36. Which of the following is not a function of the skeletal system?

[4 Marks]

(A) Storage of minerals

(B) Production of body heat

(C) Locomotion

(D) Production of erythrocytes

Explanation: Production of body heat is caused by the process of metabolism (respiration).

Question 37. A jawless fish, which lays eggs in fresh water and whose ammocoetes larva after metamorphosis return to the ocean is:

[4 Marks]

(A) Myxine

(B) Neomyxine

(C) Eptatretus

(D) Petromyzon

Explanation: Petromyzon marinus, commonly known as sea lamprey, lays eggs in fresh water and its larvae after metamorphosis return to the ocean (saline water).

Question 38. Filiform apparatus is characteristic feature of:

[4 Marks]

(A) Nucellar embryo

(B) Aleurone cell

(C) Synergids

(D) Generative cell

Explanation: Synergids have filiform apparatus.

Question 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 The correct order is:

[4 Marks]

(A) (C), (D), (B), (A)

(B) (D), (A), (C), (B)

(C) (D), (A), (C), (B)

(D) (A), (B), (D), (C)

Explanation:

The correct sequence from outer side to inner side in a woody dicot stem is as follows: Phellem → Secondary cortex → Secondary phloem → Wood. (d)→(a)→(c)→(b)

Question 40. Which one of the following hormones is not involved in sugar metabolism?

[4 Marks]

(A) Aldosterone

(B) Glucagon

(C) Insulin

(D) Cortisone

Explanation: Aldosterone is produced by adrenal cortex and plays an important role in the regulation of Na^+ and K^+ levels in body.

Question 41. Golden rice is a genetically modified crop plant where the incorporated gene is meant for biosynthesis of:

[4 Marks]

(A) Omega 3

(B) Vitamin C

(C) Vitamin B

(D) Vitamin A

Explanation: Golden rice (Oryza sativa) is a genetically modified crop. It biosynthesizes β-carotene which is the precursor of vitamin-A.

Question 42. Outbreeding is an important strategy of animal husbandry because it:

[4 Marks]

(A) is useful in producing pure lines of animals.

(B) is useful in overcoming inbreeding depression.

(C) exposes harmful recessive genes that are eliminated by selection.

(D) helps in accumulation of superior genes.

Explanation: Outbreeding is useful in the problem of inbreeding depression.

Question 43. A gene showing codominance has:

[4 Marks]

(A) A gene showing codominance has:

(B) alleles that are recessive to each other

(C) one allele dominant on the other

(D) both alleles independently expressed in the heterozygote

Explanation: In codominance both alleles are independently expressed in the heterozygote.

Question 44. Which one of the following hormones though synthesised elsewhere is stored and released by the master gland?

[4 Marks]

(A) Prolactin

(B) Luteinizing hormone

(C) Antidiuretic hormone

(D) Melanocyte stimulating hormone

Explanation: ADH (Antidiuretic hormone) and oxytocin are produced by hypothalamus and stored in posterior pituitary.

Question 45. Increase in concentration of the toxicant at successive trophic levels is known as:

[4 Marks]

(A) Biotransformation

(B) Biodeterioration

(C) Biogeochemical

(D) Biomagnification

Explanation: Biomagnification means an increase in concentration of toxins through the trophic levels of a food chain.

Question 46. Industrial melanism is an example of:

[4 Marks]

(A) Natural selection

(B) Mutation

(C) Neo Darwinism

(D) Neo Lamarckism

Explanation: Industrial melanism occurred in England due to industrial revolution. It caused black coating of moths for adaptation in the present environment.

Question 47. The primary dentition in human differs from permanent dentition in not having one of the following type of teeth:

[4 Marks]

(A) Premolars

(B) Molars

(C) Incisors

(D) Canine

Explanation: The dental formula for milk teeth is: 2102/2102 so premolars are absent in the primary dentition.

Question 48. The wheat grain has an embryo with one, large, shield-shaped cotyledon known as:

[4 Marks]

(A) Scutellum

(B) Coleorhiza

(C) Coleoptile

(D) Epiblast

Explanation: Scutellum is a large, shield-shaped cotyledon that helps in the absorption of nutrients from endosperm during germination.

Question 49. The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of:

[4 Marks]

(A) Potassium urate

(B) Urea

(C) Ammonia

(D) Calcium carbonate

Explanation: The body cells in cockroach discharge their nitrogenous waste in the haemolymph as a solution of sodium or potassium urate (a weak alkaline fluid).

Question 50. Which of the following biomolecules does have phosphodiester bond?

[4 Marks]

(A) Monosaccharides in a polysaccharide

(B) Amino acids in a polypeptide

(C) Nucleic acids in a nucleotide

(D) Fatty acids in a diglyceride

Explanation: Nucleic acids have phosphodiester bond in a nucleotide.

Question 51. The term 'linkage' was coined by:

[4 Marks]

(A) G. Mendel

(B) T. Boveri

(C) W. Sutton

(D) T.H. Morgan

Explanation: Thomas Hunt Morgan won the Nobel Prize (1933) in Physiology or Medicine for the function of chromosomes in heredity.

Question 52. Which one is wrong statement?

[4 Marks]

(A) Mucor has biflagellate zoospores

(B) Haploid endosperm is typical feature of gymnosperms

(C) Brown algae have chlorophyll a and c and fucoxanthin

(D) Archegonia are found in Bryophyta, Pteridophyta and Gymnosperms

Explanation: The spores are non-motile in Mucor.

Question 53. Ectopic pregnancies are referred to as:

[4 Marks]

(A) Implantation of embryo at site other than uterus.

(B) Implantation of defective embryo in the uterus

(C) Pregnancies terminated due to hormonal imbalance.

(D) Pregnancies with genetic abnormality.

Explanation: In ectopic pregnancies, the implantation of embryo does not occur in uterus but at another site.

Question 54. Most animals that live in deep oceanic waters are:

[4 Marks]

(A) Secondary consumers

(B) Tertiary consumers

(C) Primary consumers

(D) Detritivores

Explanation: Detritivores are the organisms which feed on dead plants and animal residues.

Question 55. Which of the following diseases is caused by a protozoan?

[4 Marks]

(A) Babesiosis

(B) Influenza

(C) Blastomycosis

(D) Syphilis

Explanation: Babesiosis is a malaria-like disease caused by protozoan Babesia. In this disease haemoglobinuric fever takes place.

Question 56. In which of the following interactions both partners are adversely affected?

[4 Marks]

(A) Predation

(B) Parasitism

(C) Mutualism

(D) Competition

Explanation: Competition occurs for light, food and space among organisms in which all partners are adversely affected in an ecosystem.

Question 57. Identify the correct order of organisation of genetic material from largest to smallest:

[4 Marks]

(A) Genome, chromosome, nucleotide, gene

(B) Genome, chromosome, gene, nucleotide

(C) Chromosome, gene, genome, nucleotide

(D) Chromosome, genome, nucleotide, gene

Explanation: Genome > chromosomes > gene > nucleotide.

Question 58.

A colour blind man marries a woman with normal sight who has no history of colour blindness in her family. 'What is the probability of their grandson being colour blind?

[4 Marks]

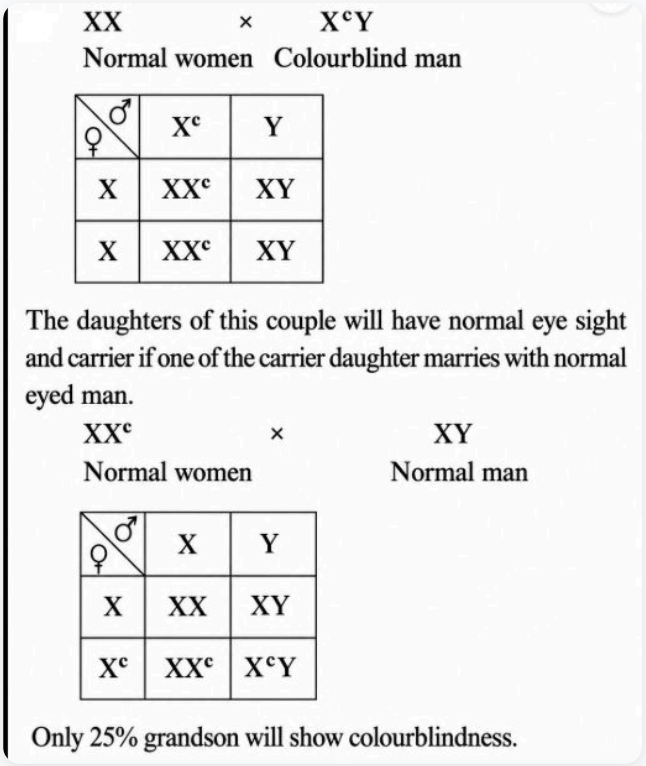
(A) 0.5

(B) 0.25

(C) Nil

(D) 1

Explanation:



Question 59. In photosynthesis the light-independent reactions take place at:

[4 Marks]

(A) Photosystem-I

(B) Photosystem-II

(C) Stromal matrix

(D) Thylakoid lumen

Explanation: Stromal matrix contains a number of flattened membranous sacs called thylakoid or lamellae.

Question 60.

In which of the following both pairs have correct combination?

[4 Marks]

(a)	Gaseous nutrient cycle	Carbon and sulphur
	Sedimentary nutrient cycle	Nitrogen and Phosphorus
(b)	Gaseous nutrient cycle	Nitrogen and sulphur
	Sedimentary nutrient cycle	Carbon and Phosphorus
(c)	Gaseous nutrient cycle	Sulphur and Phosphorus
	Sedimentary nutrient cycle	Carbon and Nitrogen
(d)	Gaseous nutrient cycle	Carbon and Nitrogen
	Sedimentary nutrient cycle	Sulphur and Phosphorus

(A) D

(B) B

(C) A

(D) C

Explanation:

Carbon and Nitrogen are gaseous nutrient cycles. Sulphur and phosphorus are sedimentary nutrient cycles.

Question 61. The introduction of t-DNA into plants involves:

[4 Marks]

(A) Exposing the plants to cold for a brief period

(B) Altering the pH of the soil, then heat shocking the plants

(C) Allowing the plant roots to stand in water

(D) Infection of the plant by Agrobacterium tumefaciens

Explanation: Agrobacterium tumefaciens introduces T-DNA into the plant.

Question 62. The wings of a bird and the wings of an insect are:

[4 Marks]

(A) Analogous structures and represent convergent evolution

(B) Phylogenetic structures and represent divergent evolution

(C) Homologous structures and represent divergent evolution

(D) Homologous structures and represent convergent evolution

Explanation: The bird's wings and insect's wings are analogous in structure. They show convergent evolution, having similar adaptive functional structures developing in different species.

Question 63. Root pressure develops due to:

[4 Marks]

(A) Passive absorption

(B) Low osmotic potential in soil

(C) Active absorption

(D) Increase in transpiration

Explanation: Active absorption creates root pressure. In this process, expenditure of energy takes place for the movement of substances against the concentration gradient.

Question 64. Human urine is usually acidic because:

[4 Marks]

(A) Excreted plasma proteins are acidic

(B) The sodium transporter exchanges one hydrogen ion for each sodium ion, in peritubular capillaries

(C) Potassium and sodium exchange generates acidity

(D) Hydrogen ions are actively secreted into the filtrate

Explanation: Urine has acidic nature because hydrogen ions (H^+) are components of an acid which are secreted into the filtrate.

Question 65. A protoplast is a cell:

[4 Marks]

(A) Without nucleus

(B) Undergoing division

(C) Without cell wall

(D) Without plasma membrane

Explanation: Cell wall is absent in a protoplast.

Question 66. The species confined to a particular region and not found elsewhere is termed as:

[4 Marks]

(A) Alien

(B) Endemic

(C) Keystone

(D) Rare

Explanation: Endemic species is confined to a particular area due to special type of adaptation according to that region.

Question 67. Select the wrong statements:

[4 Marks]

(A) The term contagium vivum fluidum was coined by M.W. Beijerinck

(B) W.M. Stanley showed that viruses could be crystallized.

(C) Mosaic disease in tobacco and AIDS in human being are caused by viruses.

(D) The viroids were discovered by D.J. Ivanowski.

Explanation: T.O. Diener (1971) discovered the viroids which are smaller than viruses.

Question 68. Axile placentation is present in:

[4 Marks]

(A) Lemon

(B) Argemone

(C) Pea

(D) Dianthus

Explanation: When the placenta is axial and ovules are attached to it in a multilocular ovary, it is known as axile placentation.

Question 69.

A childless couple can be assisted to have a child through a technique called GIFT. The full form of this technique is:

[4 Marks]

(A) Gamete internal fertilization and transfer

(B) Gamete inseminated fallopian transfer

(C) Germ cell internal fallopian transfer

(D) Gamete intra fallopian transfer

Explanation:

GIFT (Gamete Intra Fallopian Transfer) is a technique helping to have a child.

Question 70.

Destruction of the anterior horn cell of the spinal cord would result in loss of:

[4 Marks]

(A) Sensory impulses

(B) Integrating impulses

(C) Commissural impulses

(D) Voluntary motor impulses

Explanation:

In poliomyelitis, anterior horn cells of spinal cord are destroyed, which causes loss of motor activities of limbs.

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

[4 Marks]

(A) Xanthophyll

(B) Carotene

(C) Cytochrome

(D) Leghemoglobin

Explanation: Leghemoglobin prevents oxygen poisoning which causes inactivation of nitrogenase.

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

[4 Marks]

(A) Biotic community

(B) Population

(C) Ecological niche

(D) Ecosystem

Explanation: Biotic community is an association of individuals of different species living in the same habitat and showing functional interactions.

Question 73.

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

[4 Marks]

(A) Pleurisy

(B) Asthma

(C) Pneumonia

(D) Emphysema

Explanation:

In the disease emphysema, alveolar surface area is reduced due to destruction of alveolar walls.

Question 74. Balbiani rings are sites of:

[4 Marks]

(A) Nucleotide synthesis

(B) Polysaccharide synthesis

(C) Lipid synthesis

(D) RNA and protein synthesis

Explanation: RNA and protein synthesis occur in Balbiani rings.

Question 75.

Cellular organelles with membranes are:

[4 Marks]

(A) Nuclei, ribosomes and mitochondria

(B) Endoplasmic reticulum, ribosomes and nuclei

(C) Lysosomes, Golgi apparatus and mitochondria

(D) Chromosomes, ribosomes and endoplasmic reticulum

Explanation:

Lysosomes, Golgi apparatus and mitochondria are the cell organelles which have membranes.

Question 76. Auxin can be bioassayed by:

[4 Marks]

(A) Hydroponics

(B) Lettuce hypocotyl elongation

(C) Avena coleoptile curvature

(D) Potometer

Explanation: Avena coleoptile curvature is used for the bioassay.

Question 77.

Match the columns and identify the correct option.

[4 Marks]

	Column-I		Column-II
(1)	Thylakoids	(i)	Disc-shaped sacs in Golgi apparatus
(2)	Cristae	(ii)	Condensed structure of DNA
(3)	Cisternae	(iii)	Flat membranous sacs in stroma
(4)	Chromatin	(iv)	Infoldings in mitochondria

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

(A) d

(B) c

(C) b

(D) a

Explanation:

(a) → (iii), (b) → (iv), (c) → (i), (d) → (ii)

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

[4 Marks]

(A) Stroma

(B) Granulosa

(C) Zona pellucida

(D) Theca interna

Explanation: Zona pellucida is formed as a new membrane by the secondary oocyte around itself.

Question 79.

Satellite DNA is important because it:

[4 Marks]

(A) Codes for proteins needed in cell cycle.

(B) Codes for enzymes needed for DNA replication.

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

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

Explanation:

Satellite DNA displays a high degree of polymorphism in a population and also the same degree of polymorphism in an individual, which is inherited from parents to children (offsprings).

Question 80. Cell wall is absent in:

[4 Marks]

(A) Nostoc

(B) Mycoplasma

(C) Aspergillus

(D) Funaria

Explanation: Mycoplasma lacks a cell wall.

Question 81. In angiosperms, microsporogenesis and megasporogenesis:

[4 Marks]

(A) Form gametes without further divisions

(B) Involve meiosis

(C) Occur in ovule

(D) Occur in anther

Explanation: In meiosis, the number of chromosomes is reduced by half, producing haploid daughter cells. The microspore mother cell and the megaspore mother cell undergo meiosis to produce haploid microspore and megaspore respectively.

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

[4 Marks]

(A) Pistia

(B) Wheat

(C) Pea

(D) Sunflower

Explanation: Pistia is a hydrophyte plant where absorption of water by root is not important.

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

[4 Marks]

(A) Conifers

(B) Algae

(C) Fungi

(D) Lichens

Explanation: Lichens cannot grow in places where sulphur dioxide, a pollutant, is available in the environment.

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

[4 Marks]

(A) Cell-mediated immune response

(B) Passive immune response

(C) Innate immune response

(D) Humoral immune response

Explanation: Cell-mediated immune response is a system which is specialized for a particular person.

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

[4 Marks]

(A) Porifera

(B) Mollusca

(C) Coelenterata

(D) Protozoa

Explanation: The given characteristic features define the phylum Porifera.

Question 86. In which group of organisms do the cell walls form two thin overlapping shells which fit together?

[4 Marks]

(A) Euglenoids

(B) Dinoflagellates

(C) Slime moulds

(D) Chrysophytes

Explanation: In chrysophytes, the cell walls form two thin overlapping shells holding together. The body of diatoms appears like a soap box due to overlapping shells.

Question 87. Choose the wrong statements:

[4 Marks]

(A) Morels and truffles are poisonous mushrooms.

(B) Neurospora is used in the study of biochemical genetics.

(C) Yeast is unicellular and useful in fermentation.

(D) Penicillium is multicellular and produces antibiotics.

Explanation: Morel and truffles are used as food and they are members of Ascomycetes fungi.

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

[4 Marks]

(A) Uterine implantation

(B) Fertilization

(C) Puberty

(D) Birth

Explanation: Meiosis-II does not complete until fertilization occurs in females (in human beings).

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

[4 Marks]

(A) Light

(B) Essential minerals

(C) Oxygen

(D) Food

Explanation: Due to eutrophication, water bodies lack oxygen, causing death of aquatic life.

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

[4 Marks]

(A) Nucleases

(B) Nucleosidase

(C) Maltase

(D) Lipase

Explanation: Success enters cells lacking enzyme nucleases.

Question 91.

A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). What is the molar ratio of the two gases in the mixture?

[4 Marks]

(A) 1:4

(B) 4:1

(C) 2:1

(D) 16:1

Explanation:

Ratio of weight of gases = $w_{H_2} : w_{O_2} = 1:4$

Ratio of moles of gases =

$n_{H_2} : n_{O_2} = 1/2 : 4/32$

$= 1/2 \times 32/4$

∴ Molar Ratio = **4 : 1**

Question 92.

The species Ar, K^+ and Ca^{2+} contain the same number of electrons. In which order do their radii increase?

[4 Marks]

(A) $Ca^{2+} < Ar < K^+$

(B) $Ca^{2+} < K^+ < Ar$

(C) $Ar < K^+ < Ca^{2+}$

(D) $K^+ < Ar < Ca^{2+}$

Explanation:

In isoelectronic species, the radius decreases with increase in nuclear charge. Hence increasing order of radius is:

$Ca^{+2} < K^+ < Ar$

Question 93.

Which of the following pairs of ions are isoelectronic and isostructural?

[4 Marks]

(A) ClO_3^-, CO_3^{2-}

(B) SO_3^{2-}, NO_3^-

(C) CO_3^{2-}, SO_3^{2-}

(D) ClO_3^-, SO_3^{2-}

Explanation:

ClO_3^- and SO_3^{2-} both have the same number of electrons (42), and the central atom in each is **sp^3 hybridised**. Both have **one lone pair** on the central atom; hence they are **pyramidal**.

Question 94.

Maximum bond angle at nitrogen is present in which of the following?

[4 Marks]

(A) NO_2

(B) NO_3^-

(C) NO_2^+

(D) NO_2^-

Explanation:

NO_2^+ has **sp hybridisation**, so it is **linear** with bond angle:

180°.

Question 95.

The correct bond order in the following species is:

[4 Marks]

(A) $O_2^- < O_2^+ < O_2^{2+}$

(B) $O_2^{2+} < O_2^+ < O_2^-$

(C) $O_2^+ < O_2^- < O_2^{2+}$

(D) $O_2^{2+} < O_2^- < O_2^+$

Explanation:

O_2^+ ion

Total number of electrons = (16 − 1) = 15

Electronic configuration:

$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^1$

Bond order = (N_b − N_a)/2

= (10 − 5)/2

= 5/2=2(1/2)

O_2^- (Superoxide ion):

Total number of electrons = (16 + 1) = 17

Electronic configuration:

$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^1 = \pi^* 2p_z^1$

Bond order = (N_b − N_a)/2

= (10 − 7)/2

= 3/2 = 1½

O_2^{2+} ion:

Total number of electrons = (16 − 2) = 14

Electronic configuration:

$\sigma 1s^2 < \sigma 1s^2 < \sigma 2s^2 < \sigma 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2$

Bond order = (N_b − N_a)/2

= (10 − 4)/2

= 6/2

= **3**

So, **bond order: $O_2^- < O_2 < O_2^+ < O_2^{2+}$**

Question 96.

Which of the following options represents the correct bond order?

[4 Marks]

(A) $O_2 < O_2^- < O_2^+$

(B) $O_2^- > O_2 > O_2^+$

(C) $O_2^- < O_2 > O_2^+$

(D) $O_2^- > O_2 > O_2^+$

Explanation:

Oxygen molecule (O_2)

Total number of electrons = 16

Electronic configuration:

$\sigma 1s^2 < \sigma 1s^2 < \sigma 2s^2 < \sigma 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi 2p_y^1 = \pi 2p_z^1$

Bond order = $(N_b - N_a)/2$

$= (10 - 6)/2$

$= 4/2$

$=$ **2**

O_2^+ ion

Total number of electrons = (16 − 1) = 15

Electronic configuration:

$\sigma 1s^2 < \sigma 1s^2 < \sigma 2s^2 < \sigma 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^1$

Bond order = $(N_b - N_a)/2$

$= (10 - 5)/2$

$= 5/2$

$=$ **2½**

O_2^- (Superoxide ion)

Total number of electrons = (16 + 1) = 17

Electronic configuration:

$\sigma 1s^2 < \sigma 1s^2 < \sigma 2s^2 < \sigma 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi 2p_y^2 = \pi 2p_z^1$.

Bond order = $(N_b - N_a)/2$

$= (10 - 7)/2$

$= 3/2$

= **1½**

Question 97.

Which of the following species contains equal number of σ- and π-bonds?

[4 Marks]

(A) XeO_4

(B) $(CN)_2$

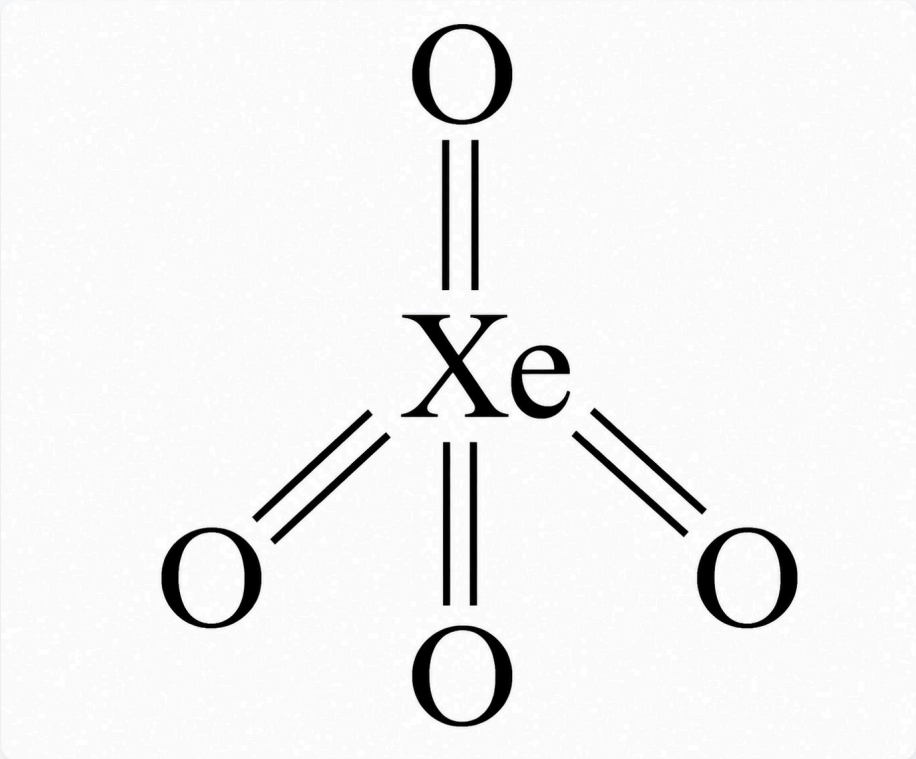
(C) $CH_2(CN)_2$

(D) HCO_3^-

Explanation:

Number of σ bonds = 4

Number of π bonds = 4



Question 98.

If the value of an equilibrium constant for a particular reaction is **1.6×10^{12}**, then at equilibrium the system will contain:

[4 Marks]

(A) All reactants

(B) Mostly products

(C) Similar amounts of reactants and products

(D) Mostly reactants

Explanation:

Equilibrium constant for reaction:

$K = 1.6 \times 10^{12}$ = [Product] / [Rectant]

The value of **K** is very high, so the system will contain **mostly products at equilibrium**.

Question 99.

Which of the following statements is correct for a reversible process in a state of equilibrium?

[4 Marks]

(A) $\Delta G = -2.30\ RT \log K$

(B) $\Delta G^\circ = 2.30\ RT \log K$

(C) $\Delta G = 2.30\ RT \log K$

(D) $\Delta G^\circ = -2.30\ RT \log K$

Explanation:

$\Delta G^\circ = -2.30 RT \log K$

because at equilibrium $\Delta G = 0$

Question 100.

The K_{sp} of **Ag_2CrO_4, AgCl, AgBr** and **AgI** are respectively,

1.1×10^{-12}, 1.8×10^{-10}, 5.0×10^{-13}, 8.3×10^{-17}

Which of the following salts will precipitate first on adding **$AgNO_3$** solution to a solution containing equal moles of **NaCl, NaBr, NaI** and **Na_2CrO_4**?

[4 Marks]

(A) AgBr

(B) Ag_2CrO_4

(C) AgCl

(D) AgI

Explanation:

Ag_2CrO_4

$$K_{sp} = [Ag^+]^2 [CrO_4^{2-}] = 1.1 \times 10^{-12}$$

$$[Ag^+] = \sqrt{\frac{1.1 \times 10^{-12}}{[CrO_4^{2-}]}}$$

AgCl

$$K_{sp} = [Ag^+][Cl^-] = 1.8 \times 10^{-10}$$

$$[Ag^+] = \frac{1.8 \times 10^{-10}}{[Cl^-]}$$

AgBr

$$K_{sp} = [Ag^+][Br^-] = 5.0 \times 10^{-13}$$

$$[Ag^+] = \frac{5.3 \times 10^{-13}}{[Br^-]}$$

AgI

$$K_{sp} = [Ag^+][I^-] = 8.3 \times 10^{-17}$$

$$[Ag^+] = \frac{8.3 \times 10^{-17}}{[I^-]}$$

If we take $[CrO_4^{2-}] = [Cl^-] = [Br^-] = [I^-] = 1$

then maximum $[Ag^+]$ will be required in case of Ag_2CrO_4.

Question 101.

The function of "Sodium pump" is a biological process operating in each and every cell of all animals. Which of the following biologically important ions is also a constituent of this pump?

[4 Marks]

(A) K^+

(B) Mg^{2+}

(C) Ca^{2+}

(D) Fe^{2+}

Explanation:

In sodium pump, high concentration of potassium ions and a low concentration of sodium ions are maintained within a cell by a plasma membrane protein.

Question 102.

Solubility of the alkaline earth's metal sulphates in water decreases in the sequence:

[4 Marks]

(A) Ca > Sr > Ba > Mg

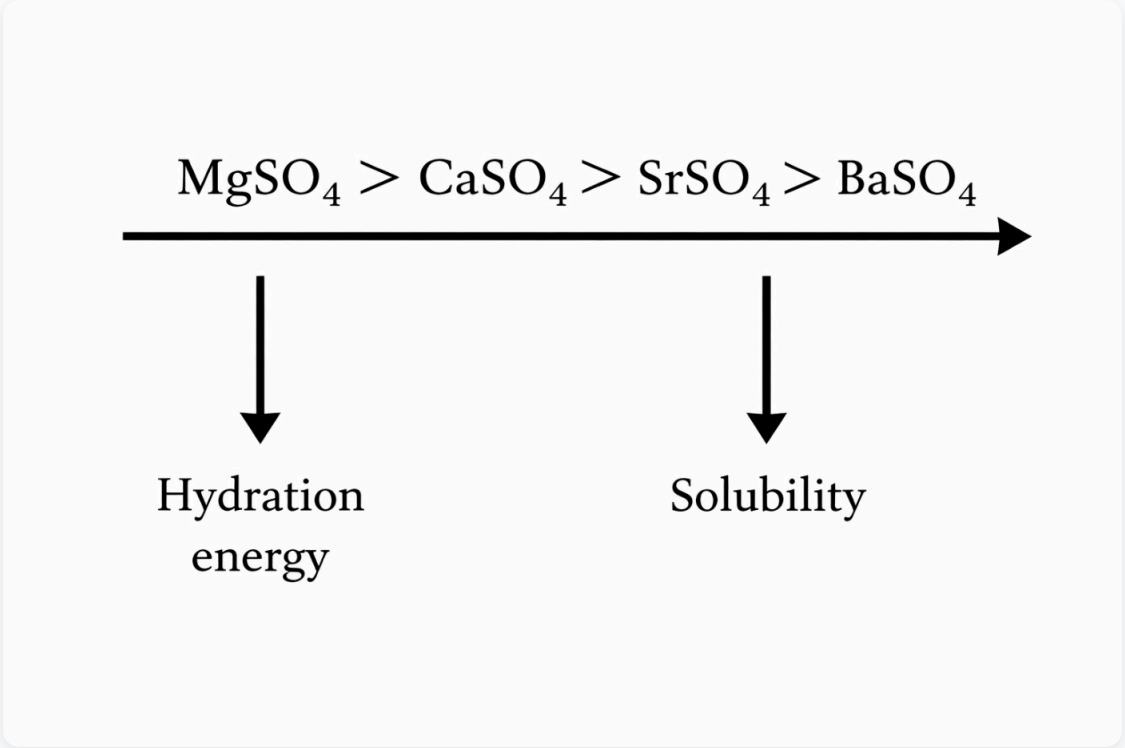
(B) Sr > Ca > Mg > Ba

(C) Ba > Mg > Sr > Ca

(D) Mg > Ca > Sr > Ba

Explanation:

Solubility of alkaline earth metal sulphates decreases down the group due to decrease in hydration energy.

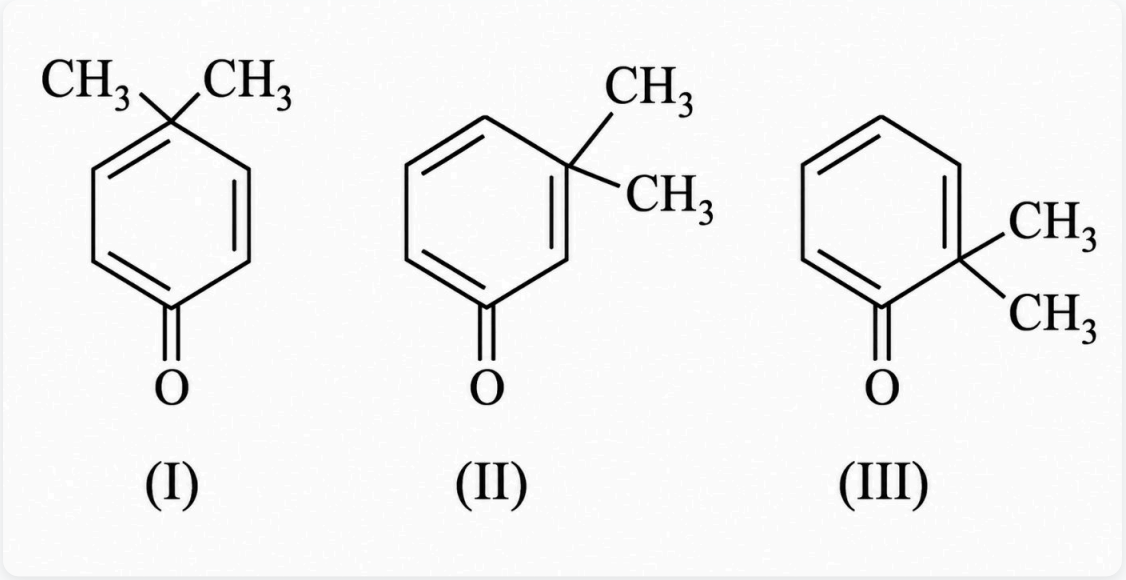


Question 103.

Given

Which of the given compounds can exhibit tautomerism?

[4 Marks]



(A) II and III

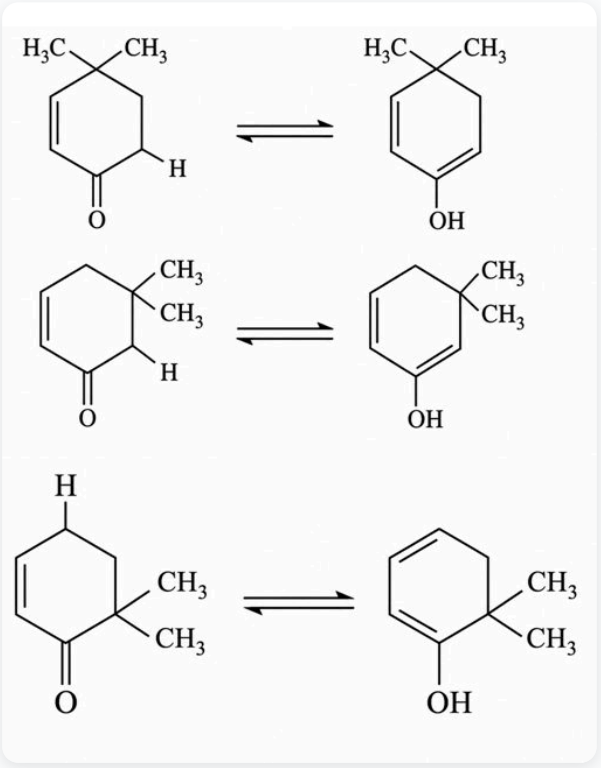
(B) I and III

(C) I, II and III

(D) I and II

Explanation:

All of these compounds show tautomerism.

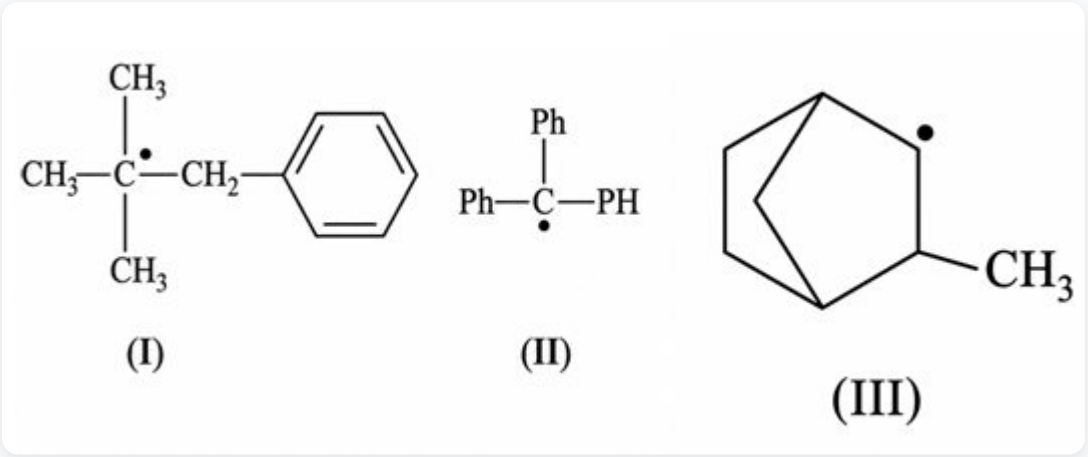


Question 104.

Consider the following compounds

Hyperconjugation occurs in :

[4 Marks]



(A) I only

(B) II only

(C) I and III

(D) III only

Explanation:

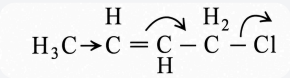
Only structure (III) has H in conjugation with free radical. So, hyperconjugation is possible in III only.

Question 105.

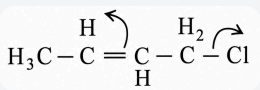
Which of the following is the most correct electron displacement for a nucleophilic reaction to take place?

[4 Marks]

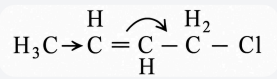
(A)



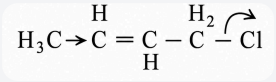
(B)



(C)

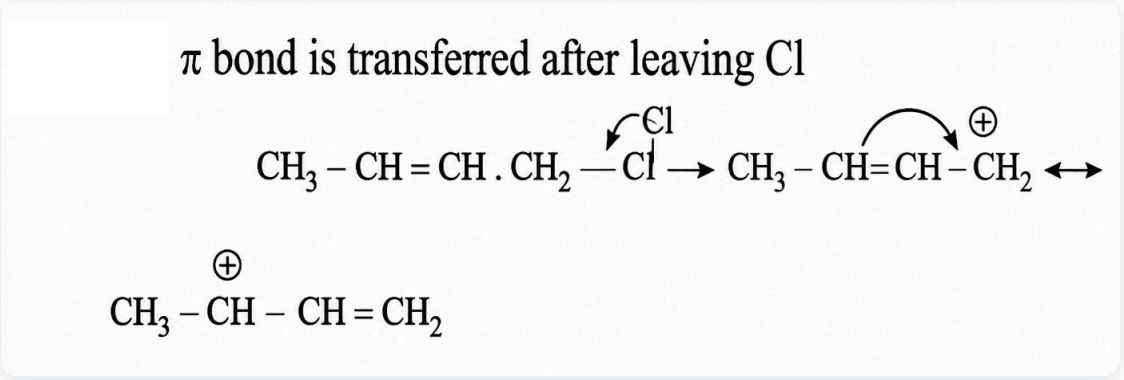


(D)



Explanation:

.



Question 106.

In Duma's method for estimation of nitrogen, 0.25 g of an organic compound gave 40 mL of nitrogen collected at 300 K temperature and 725 mm pressure. If the aqueous tension at 300 K is 25 mm, the percentage of nitrogen in the compound is:

[4 Marks]

(A) 16.76

(B) 15.76

(C) 17.36

(D) 18.20

Explanation:

Wt. of organic substance = 0.25 g

V_1 = 40 mL, T_1 = 300 K

P_1 = 725 − 25 = 700 mm of Hg

P_2 = 760 mm of Hg (at STP)

T_2 = 273 K

$P_1V_1/T_1 = P_2V_2/T_2$

V_2 (Volume of nitrogen at STP)

V_2 = 273 × 700 × 40 / 300 × 760 = 33.52 mL

Percentage of nitrogen = 28 × Volume of N_2 at STP × 100 / 22400 × **Wt. of organic substance**

= 28 × 33.52 × 100 / 22400 × 0.25

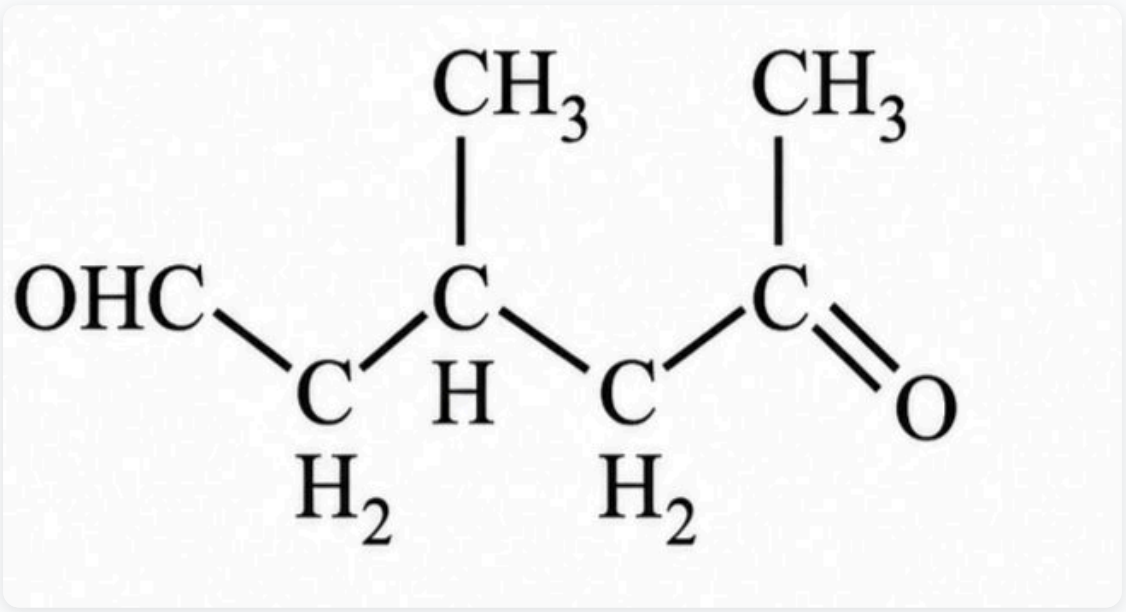
= 16.76 %

Question 107.

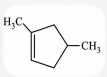
A single compound of the structure :

is obtainable from ozonolysis of which of the following cyclic compounds ?

[4 Marks]



(A)



(B)



(C)

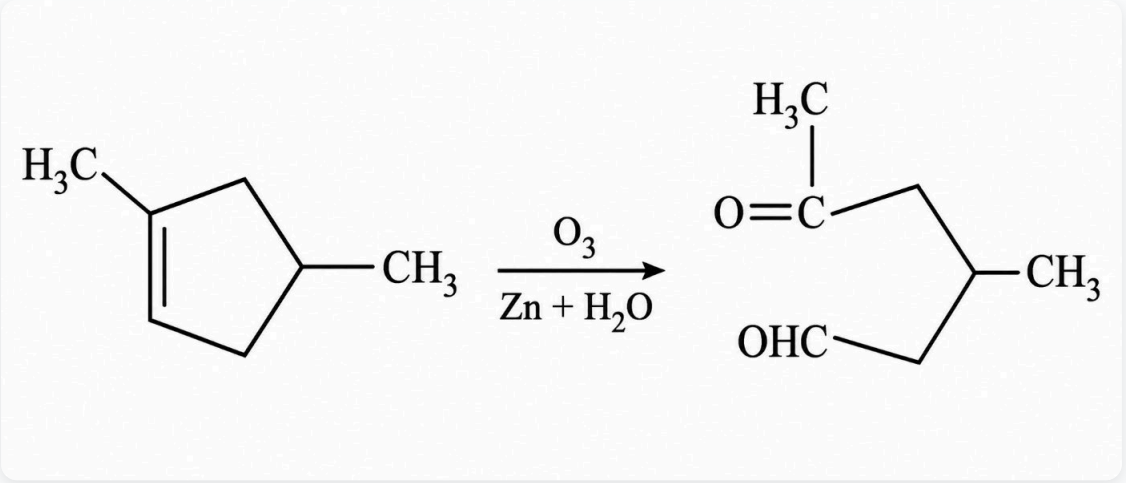


(D)



Explanation:

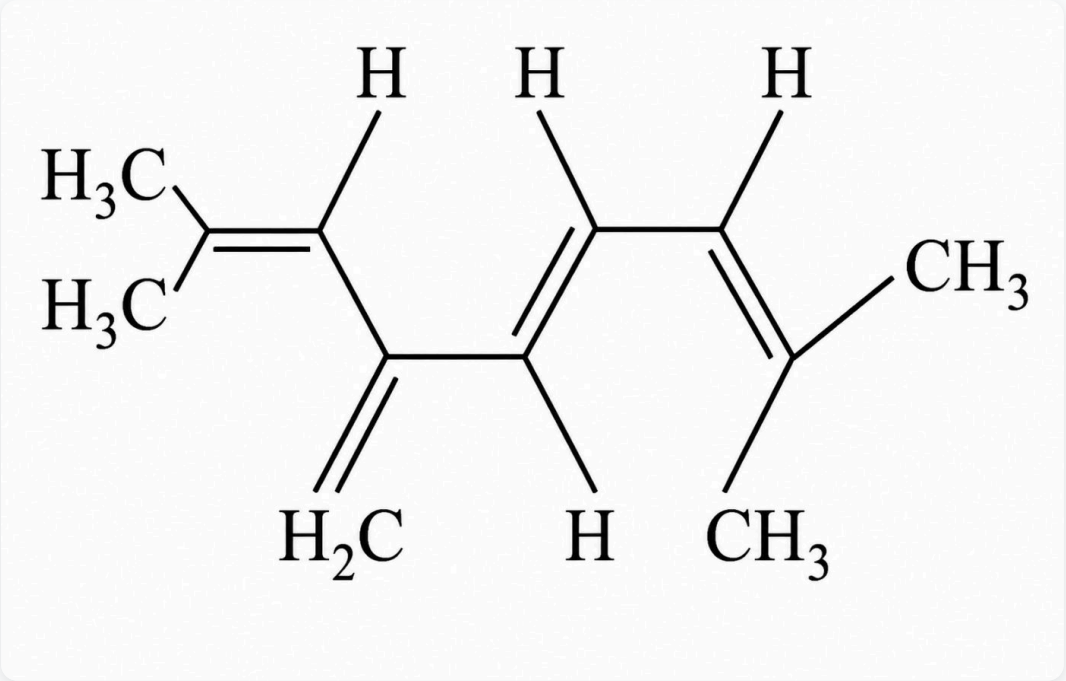
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Question 108.

The total number of **π** - bond electrons in the following structure is :

[4 Marks]



(A) 8

(B) 16

(C) 12

(D) 4

Explanation:

No. of double bonds = **4**

No. of π bond electrons

= 2 × No. of double bonds

= 2 × 4

= **8**

Question 109.

Which one is not equal to zero for an ideal solution?

[4 Marks]

(A) ΔH_{mix}

(B) $\Delta P = P_{observed} - P_{raoult}$

(C) ΔS_{mix}

(D) ΔV_{mix}

Explanation:

For an ideal solution, **$\Delta S_{mix} > 0$**

Entropy will always increase upon mixing two compounds as disorder increases.

Question 110.

The oxidation of benzene by V_2O_5 in presence of air produces:

[4 Marks]

(A) Benzoic anhydride

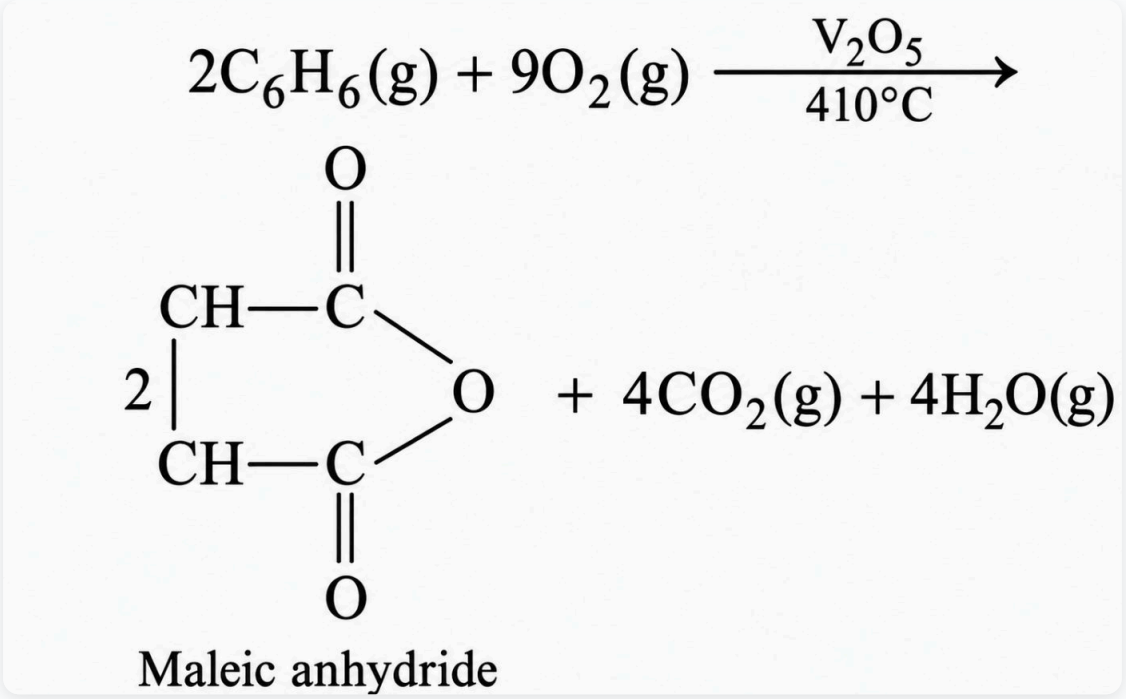
(B) Benzoic acid

(C) Maleic anhydride

(D) Benzaldehyde

Explanation:

.



Question 111.

Which one of the following electrolytes has the same value of van't Hoff's factor (i) as that of $Al_2(SO_4)_3$ (if all are 100% ionised)?

[4 Marks]

(A) K_2SO_4

(B) $Al(NO_3)_3$

(C) $K_4[Fe(CN)_6]$

(D) $K_3[Fe(CN)_6]$

Explanation:

$K_4[Fe(CN)_6] \rightleftharpoons 4K^+ + [\ Fe(CN)_6]^-$

and

$Al_2(SO_4)_3 \rightarrow 2Al^{3+} + 3SO_4^{2-}$

Van't Hoff factor is **5** for both $Al_2(SO_4)_3$ and $K_4[Fe(CN)_6]$.

Question 112.

The boiling point of 0.2 mol kg^{-1} solution of X in water is greater than equimolal solution of Y in water. Which one of the following statements is true in this case?

[4 Marks]

(A) Molecular mass of X is greater than the molecular mass of Y.

(B) Molecular mass of X is less than the molecular mass of Y.

(C) X is undergoing dissociation in water.

(D) Y is undergoing dissociation in water while X undergoes no change.

Explanation:

$\Delta T_b = iK_bm$

Given, $(\Delta T_b)_x > (\Delta T_b)_y$

$i_xK_b\ m > i_yK_b\ m$

(K_b is the same for the same solvent)

So, $i_x > i_y$

So, x is undergoing dissociation in water.

Question 113.

A device that converts energy of combustion of fuels like hydrogen and methane, directly into electrical energy is known as:

[4 Marks]

(A) Dynamo

(B) Electrolytic cell

(C) Ni-Cd cell

(D) Fuel Cell

Explanation:

A device that converts energy of combustion of fuels, directly into electrical energy is known as fuel cell.

Question 114.

When initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction is:

[4 Marks]

(A) Zero

(B) More than zero but less than first

(C) Second

(D) First

Explanation:

$t_{1/2} = 0.693/k$

For a first-order reaction, $t_{1/2}$ is independent of the initial concentration of the reactant.

Question 115.

The activation energy of a reaction can be determined from the slope of which of the following graphs?

[4 Marks]

(A) ln K/T vs. T

(B) ln K vs. 1/T

(C) T/lnK vs. 1/T

(D) ln K vs. T

Explanation:

Arrhenius equation

$K = Ae^{-E_a/Rt}$

$\ln K = \ln A - E_aRT$

$\text{slope} = -E_a/R$

So, the activation energy of a reaction can be determined from the slope of the graph of **lnK vs 1/T.**.

Question 116.

Which property of colloidal solution is independent of charge on the colloidal particles?

[4 Marks]

(A) Electrophoresis

(B) Electro-osmosis

(C) Tyndall effect

(D) Coagulation

Explanation:

Tyndall effect is an optical property, and it is independent of charge on colloidal particles.

Question 117.

Metals are usually not found as nitrates in their ores". Out of the following two (i) and (ii) reasons which is/are true for the above observation?

(i) Metal nitrates are highly unstable.

(ii) Metal nitrates are highly soluble in water.

[4 Marks]

(A) (i) is false but (ii) is true

(B) (i) and (ii) are false

(C) (i) is true but (ii) is false

(D) (i) and (ii) are true

Explanation:

Metal nitrates are highly soluble in water and are very stable, e.g., $NaNO_3$ and KNO_3.

Question 118.

Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds, but not by the other?

[4 Marks]

(A) forms acid rain

(B) Is used as a food-preservative

(C) Is soluble in water

(D) Is a reducing agent

Explanation:

SO_2 is widely used in food and drinks industries for its property as a preservative and antioxidant, while NO_2 is not used as a food preservative.

Question 119.

Magnetic moment **2.84 B.M.** is given by:

(At. nos., Ti = 22, Cr = 24, Co = 27, Ni = 28)

[4 Marks]

(A) Cr^{2+}

(B) Ti^{3+}

(C) Co^{2+}

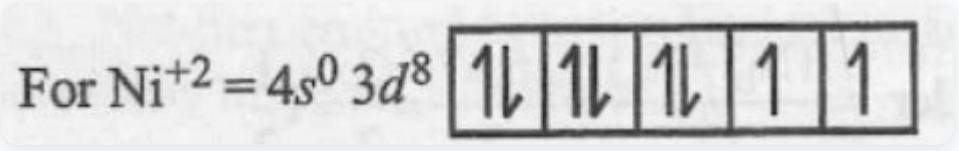
(D) Ni^{2+}

Explanation:

Magnetic moment = 2.84 B.M. This indicates that **2 unpaired electrons** are present.

Number of unpaired electrons (n) = 2

Hence, **Ni^{2+}** gives a magnetic moment of **2.84 B.M.**



Question 120.

The number of *d*-electrons in **Fe^{2+} (Z = 26)** is not equal to the number of electrons in which one of the following?

[4 Marks]

(A) p-electrons in Ne (Z = 10)

(B) s-electrons in Mg (Z = 12)

(C) p-electrons in Cl (Z = 17)

(D) d-electrons in Fe (Z = 26)

Explanation:

$Fe^{2+} = 3d^6$ (Number of *d*-electrons = 6)

In **Cl = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$**

Total *p*-electrons = **11**, which are not equal to the number of *d*-electrons in **Fe^{2+}**.

p-electrons in **Ne** = **$1s^2\ 2s^2\ 2p^6 = 6$**

s-electrons in **Mg** = **$1s^2\ 2s^2\ 2p^6\ 3s^2 = 6$**

Question 121.

Which of the following processes does not involve oxidation of iron?

[4 Marks]

(A) Liberation of H_2 from steam by iron at high temperature

(B) Formation of $Fe(CO)_5$ from Fe

(C) Decolourization of blue $CuSO_4$ solution by iron

(D) Rusting of iron sheets exposed to air

Explanation:

Formation of **$Fe(CO)_5$** from Fe involves no change in oxidation state of iron.

Question 122.

Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii? (Numbers in the parentheses are atomic numbers.)

[4 Marks]

(A) Ti (22) and Zr (40)

(B) Zr (40) and Hf (72)

(C) Zr (40) and Ta (73)

(D) Zr (40) and Nb (41)

Explanation:

Zr (40) and **Hf (72)** are in the same group (4). Because of lanthanoid contraction, they have nearly same atomic radii.

Question 123.

Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not give chloride ions with silver nitrate at 25°C?

[4 Marks]

(A) $CoCl_3 \cdot 4NH_3$

(B) $CoCl_3 \cdot 5NH_3$

(C) $CoCl_3 \cdot 6NH_3$

(D) $CoCl_3 \cdot 3NH_3$

Explanation:

$[CoCl_3 \cdot 3NH_3]$ will not give test for chloride ions with silver nitrate due to absence of ionisable chloride atoms.

$[CoCl_3 \cdot 3NH_3] \equiv [Co(NH_3)_3Cl_3]$

$[Co(NH_3)_3Cl_3]$ $-AgNO_3 \rightarrow$ No ppt

Question 124.

Which of these statements about $[Co(CN)_6]^{3-}$ is true?

[4 Marks]

(A) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a high-spin configuration.

(B) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a high-spin configuration.

(C) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a low-spin configuration.

(D) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a low-spin configuration.

Explanation:

In **$[Co(CN)_6]^{3-}$**, the oxidation number (O.N.) of **Co** is **+3**.

$CO^{3+} = 3d^6 4s^0$

CN^- is a strong field ligand.

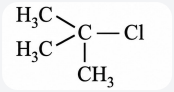
Therefore, pairing of electrons occurs in this complex. Hence, **no unpaired electron is present** and it is a **low-spin complex**.

Question 125.

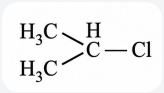
In which of the following compounds, the **C–Cl** bond ionisation shall give the most stable carbonium ion?

[4 Marks]

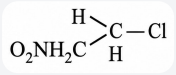
(A)



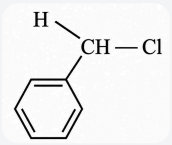
(B)



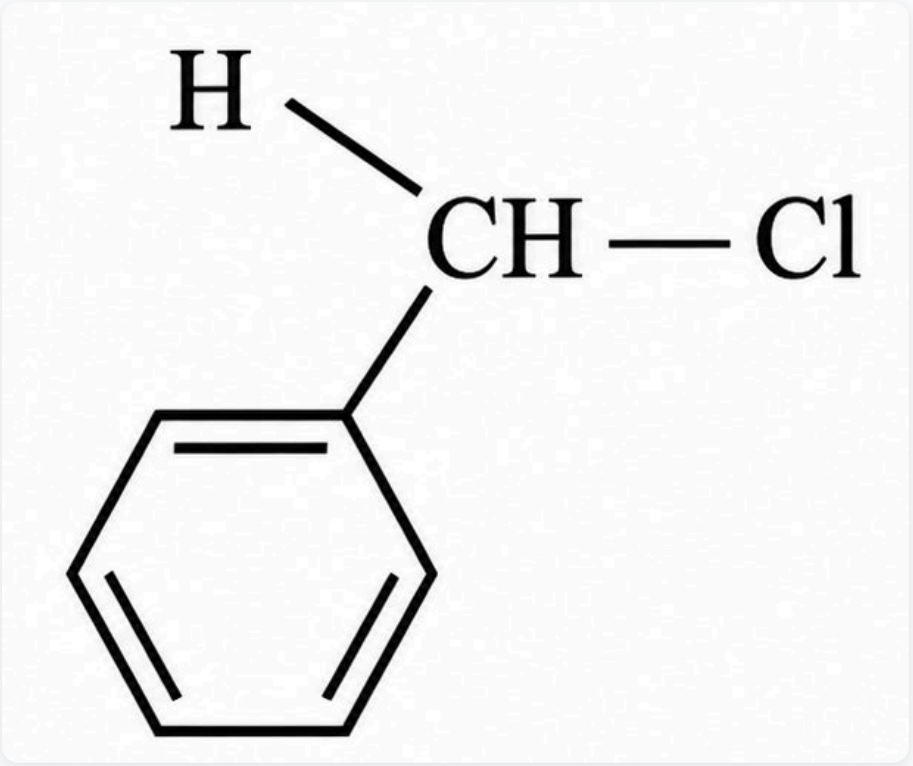
(C)



(D)



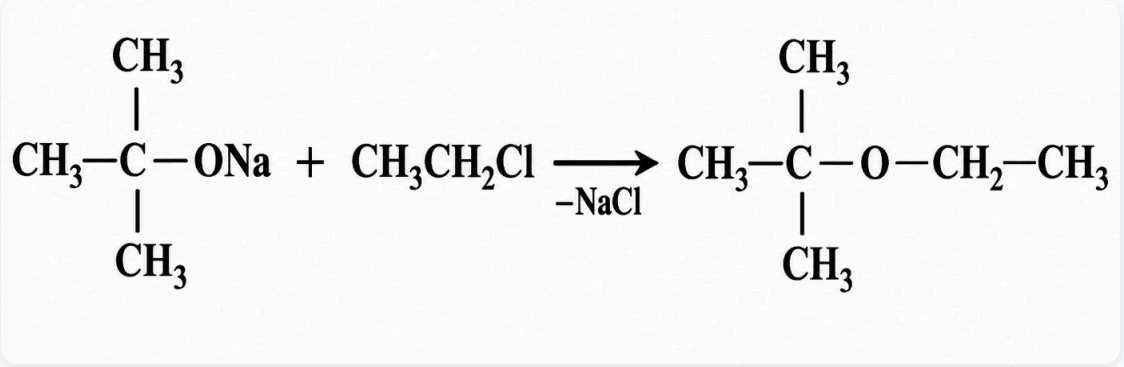
Explanation:



Question 126.

The reaction is called :

[4 Marks]



(A) Gatterman - Koch reaction

(B) Williamson Synthesis

(C) Williamson continuous etherification process

(D) Etard reaction

Explanation:

Williamson synthesis is one of the best methods for the preparation of symmetrical and unsymmetrical ethers. In this method, an alkyl halide is allowed to react with sodium alkoxide.

Question 127.

An organic compound **'X'** having molecular formula **$C_5H_{10}O$** yields phenyl hydrazone and gives negative response to the iodoform test and Tollen's test. It produces **n-pentane** on reduction. **'X'** could be:

[4 Marks]

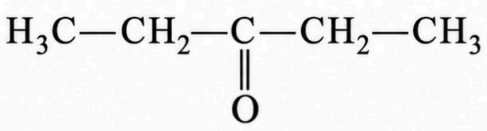
(A) 2-Pentanone

(B) 3-Pentanone

(C) Pentanal

(D) n-Amyl alcohol

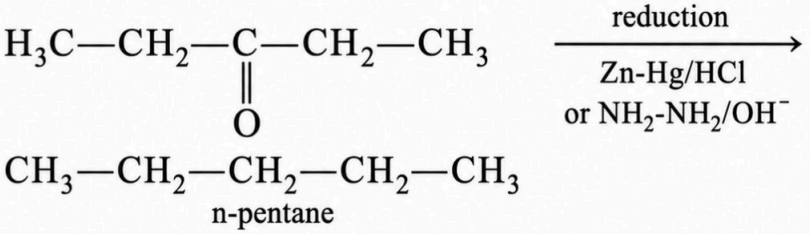
Answer:



does not give iodoform test due to absence of $(CH_3—\overset{\overset{O}{\|}}{C}—)$

It also does not give Tollen's test.

On reduction, it gives n-pentane



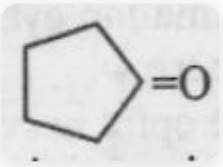
$CH_3—CH_2—CH_2—CH_2—CH_3$

n-pentane

Question 128.

Treatment of **cyclopentanone** with **methyl lithium** gives which of the following species?

[4 Marks]



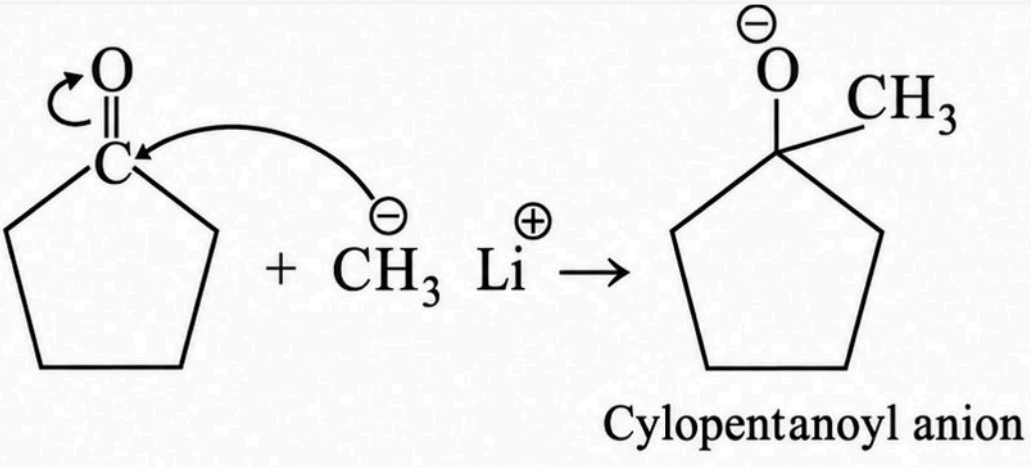
(A) Cyclopentanonyl radical

(B) Cyclopentanonyl anion

(C) Cyclopentanonyl cation

(D) Cyclopentanonyl biradical

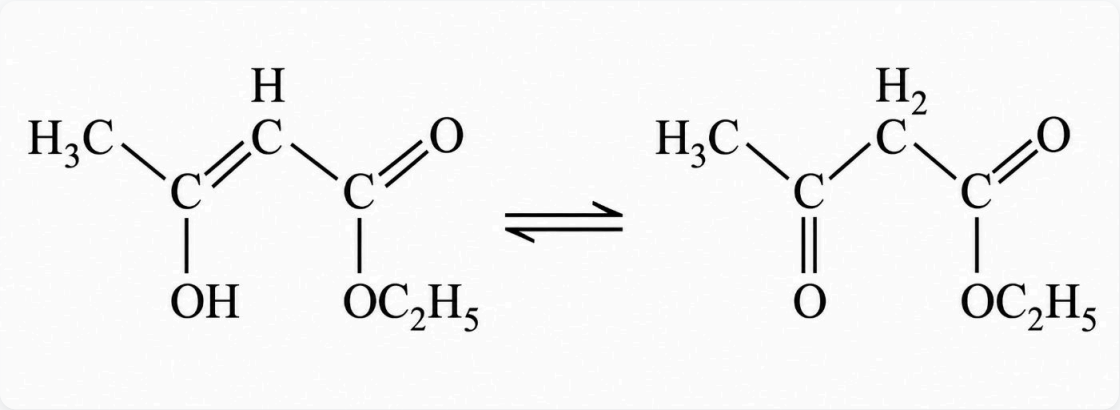
Explanation:



Question 129.

The enolic form of ethyl acetoacetate as below has:

[4 Marks]



(A) 18 sigma bonds and 2 pi - bonds

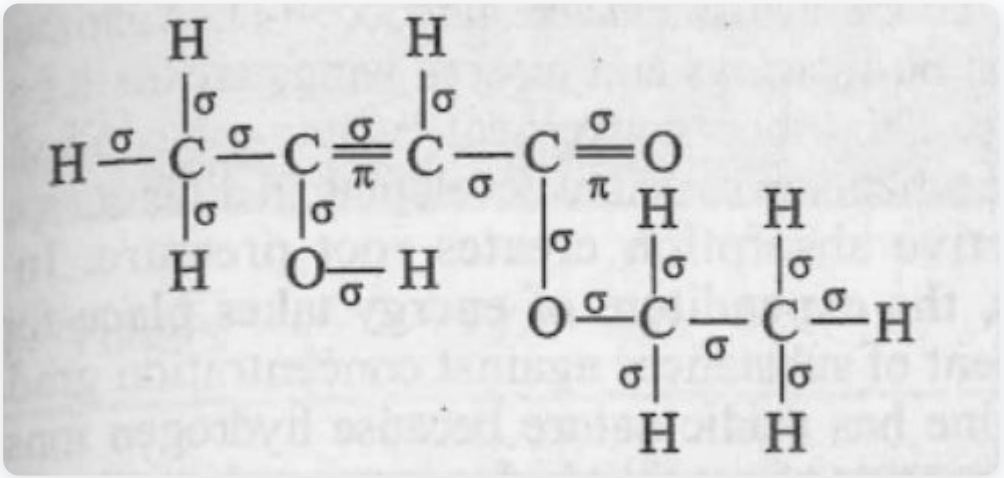
(B) 9 sigma bondsand 1 pi - bond

(C) 9 sigma bonds and 2 pi - bonds

(D) 16 sigma bonds and 1 pi - bond

Explanation:

Enolic form of ethyl acetoacetate has 18 sigma and 2 pi-bonds as shown below:



Question 130.

The electrolytic reduction of nitrobenzene in strongly acidic medium produces:

[4 Marks]

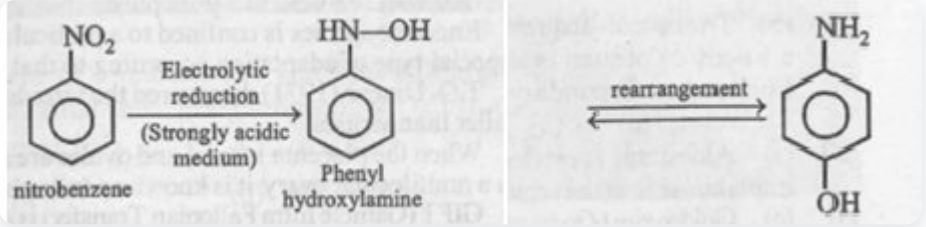
(A) Azoxybenzene

(B) Aniline

(C) p-Aminophenol

(D) Azobenzene

Explanation:



Question 131.

Biodegradable polymer which can be produced from glycine and aminocaproic acid is:

[4 Marks]

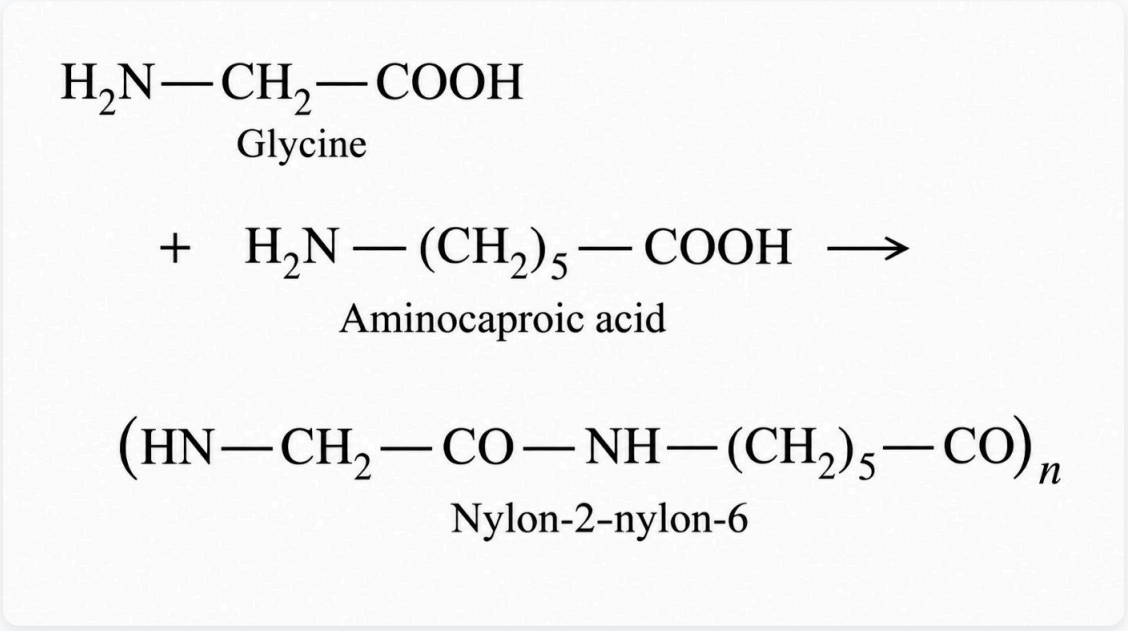
(A) Nylon 2–Nylon 6

(B) Buna-N

(C) Nylon 6,6

(D) PHBV

Explanation:



Question 132.

Bithionol is generally added to soaps as an additive to function as a/an:

[4 Marks]

(A) Buffering agent

(B) Dryer

(C) Antiseptic

(D) Softener

Explanation:

Bithionol is added to soaps to impart antiseptic properties.

Question 133.

The angular momentum of electron in **'d'** orbital is equal to:

[4 Marks]

(A) √2h

(B) 2√3h

(C) 0h

(D) √6h

Explanation:

Orbital angular momentum = √(l(l+1)h

For d-orbital l = 2

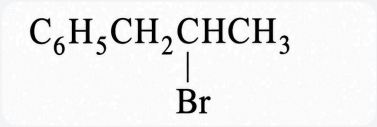
angular momentum = √2(2+1)h = √6h

Question 134.

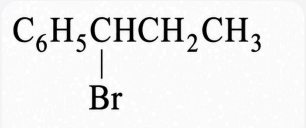
The reaction of $C_6H_5CH = CHCH_3$ with HBr produces:

[4 Marks]

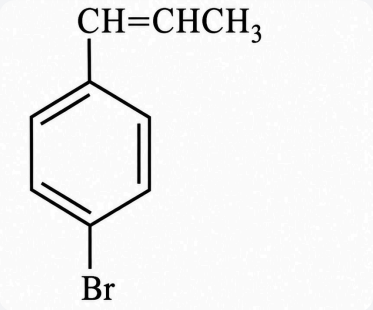
(A)



(B)



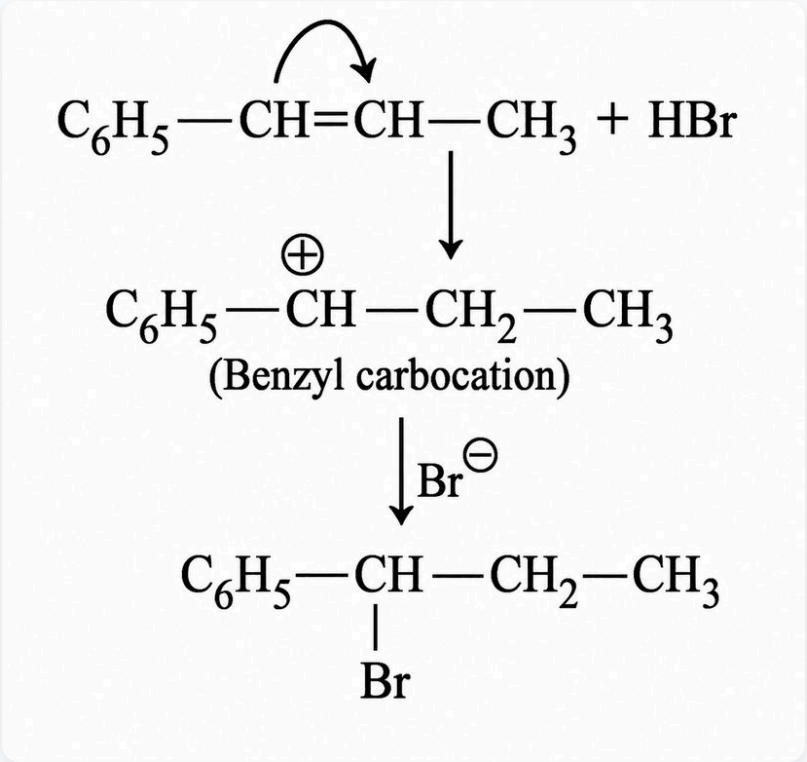
(C)



(D)

$C_6H_5CH_2CH_2CH_2Br$

Explanation:

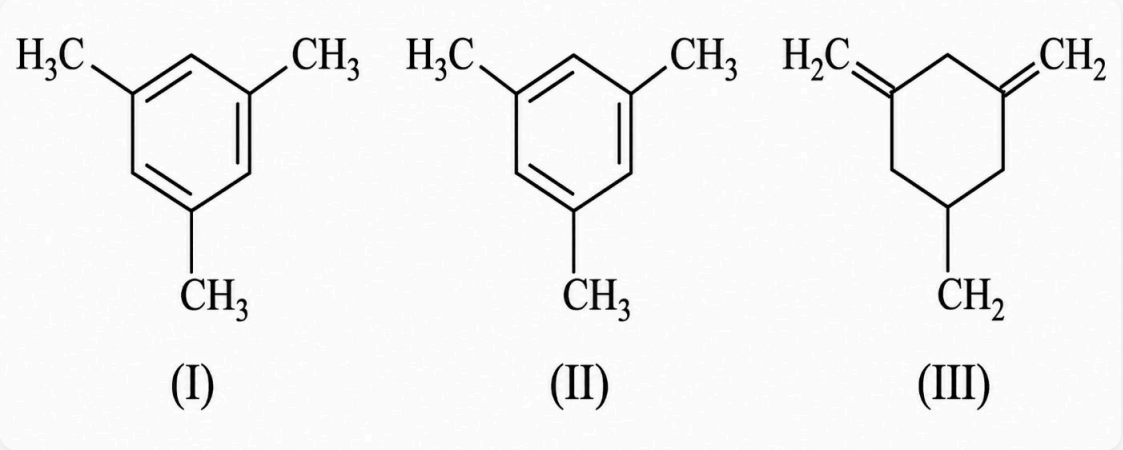


Question 135.

Given:

The enthalpy of the hydrogenation of these compounds will be in the order as :

[4 Marks]



(A) II > I > III

(B) I > II > III

(C) II > III > I

(D) III > II > I

Explanation:

Enthalpy of hydrogenation ∝ 1/stability of alkene

∴ III > II > I

Question 136.

If energy (E), velocity (V) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be:

[4 Marks]

(A) $[EV^{-1}T^{-2}]$

(B) $[EV^{-2}T^{-1}]$

(C) $[EV^{-2}T^{-2}]$

(D) $[E^{-2}V^{-1}T^{-3}]$

Explanation:

As we know that,

Surface tension (S) = Force(F)/Length(L)

So, $[S] = [MLT^{-2}]/[L] = [MT^{-2}]$

Energy (E) = Force × Displacement

$[E] = [ML^{-2}T^{-2}]$

Velocity (V) = displacement/time

$[V] = [LT^{-1}]$

Let surface tension be expressed as, $S = E^aV^bT^c$

where a, b, c are constants.

Putting the dimensions,

$[MLT^{-2}]/[L] = [ML^2T^{-2}]^a[L/T]^b[T]^c$

From the principle of homogeneity,

Equating the dimensions of LHS and RHS,

$[ML^0T^{-2}] = [M^aL^{2a+b}T^{-2a-b+c}]$

$\Rightarrow a = 1, 2a + b = 0, -2a - b + c = -2$

$\Rightarrow a = 1, b = -2, c = -2$

Hence, the dimensions of surface tension are $[EV^{-2}T^{-2}]$.

Question 137.

A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to $v(x) = bx^{-2n}$ where **b** and **n** are constants and **x** is the position of the particle. The acceleration of the particle as the function of **x**, is given by:

[4 Marks]

(A) $-2nb^2e^{-4n+1}$

(B) $-2nb^2x^{-2n-1}$

(C) $-2nb^2x^{-4n-1}$

(D) $-2b^2x^{-2n+1}$

Explanation:

Given, $v(x) = bx^{-2n}$

$a = dv/dt = dv/dx \cdot dx/dt = v.dv/dx$

So, $dv/dx = -2\ nbx^{-2n-1}$

Acceleration of the particle as function of x,

$a = v.dv/dx = bx^{-2n} \{b(-2n)x^{-2n-1}\} = -2nb^2x^{-4n-1}$

Question 138.

A ship **A** is moving Westwards with a speed of **10 km h⁻¹** and a ship **B**, **100 km** South of **A**, is moving Northwards with a speed of **10 km h⁻¹**. The time after which the distance between them becomes shortest, is:

[4 Marks]

(A) 0 h

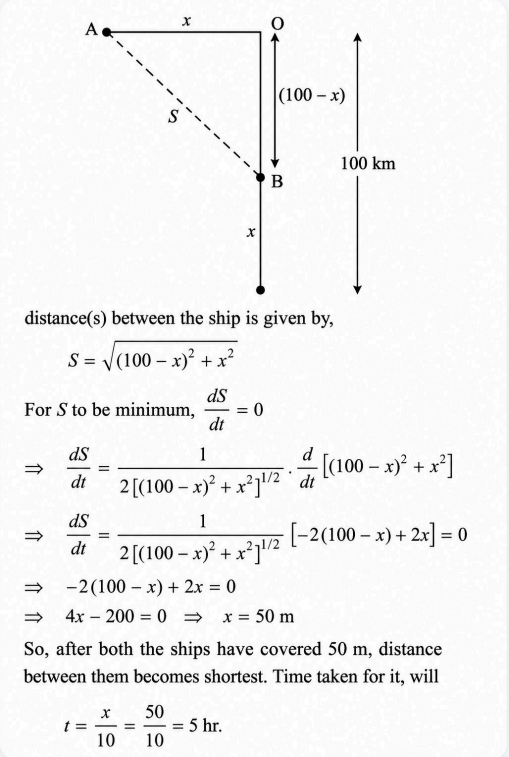
(B) 10√2 h

(C) 5√2 h

(D) 5 h

Explanation:

Let t be the time passed and x be distance covered by the two ships after which the distance between them becomes shortest.



distance(s) between the ship is given by,

$$S = \sqrt{(100-x)^2 + x^2}$$

For S to be minimum, $\frac{dS}{dt} = 0$

$$\Rightarrow \quad \frac{dS}{dt} = \frac{1}{2\left[(100-x)^2 + x^2\right]^{1/2}} \cdot \frac{d}{dt}\left[(100-x)^2 + x^2\right]$$

$$\Rightarrow \quad \frac{dS}{dt} = \frac{1}{2\left[(100-x)^2 + x^2\right]^{1/2}} \left[-2(100-x) + 2x\right] = 0$$

$$\Rightarrow \quad -2(100-x) + 2x = 0$$

$$\Rightarrow \quad 4x - 200 = 0 \quad \Rightarrow \quad x = 50 \text{ m}$$

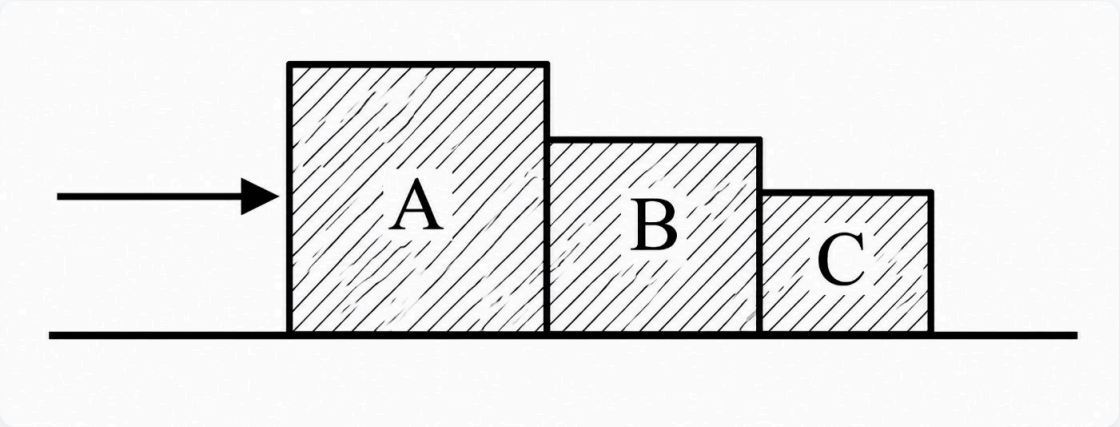
So, after both the ships have covered 50 m, distance between them becomes shortest. Time taken for it, will

$$t = \frac{x}{10} = \frac{50}{10} = 5 \text{ hr.}$$

Question 139.

Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block then the contact force between A and B is

[4 Marks]



(A) 6 N

(B) 8 N

(C) 18 N

(D) 2 N

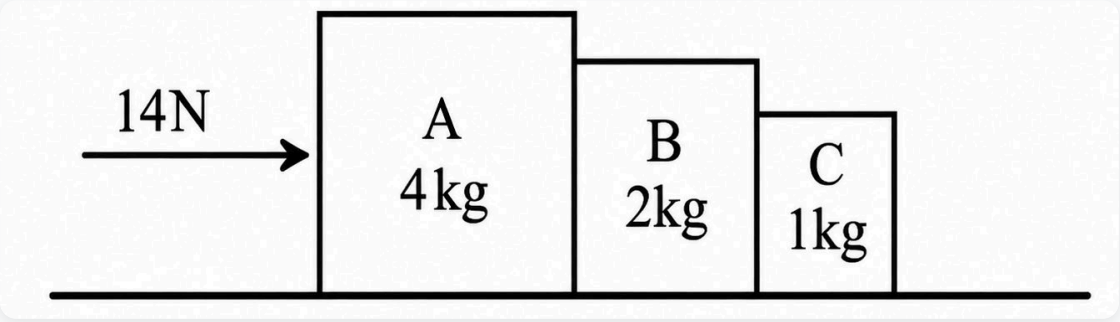
Explanation:

Acceleration of system, $a = F_{net}/M_{total}$

$= 14/4+2+1 = 14/2 = 2\ m/s^2$

The contact force between A and B

$= (m_B + m_C) \times a = (2+1)\times 2 = 6N$



Question 140.

A block **A** of mass $\mathbf{m_1}$ rests on a horizontal table. A light string connected to it passes over a frictionless pulley at the edge of the table and from its other end another block **B** of mass $\mathbf{m_2}$ is suspended. The coefficient of kinetic friction between the block and the table is μ_k. When the block **A** is sliding on the table, the tension in the string is:

[4 Marks]

(A) $m_1m_2(1-\mu_k)g / m_1+m_2$

(B) $(m_2-+\mu_k m_1)g / m_1+m_2$

(C) $m_1m_2(1+\mu_k)g / m_1+m_2$

(D) $(m_2-\mu_k m_1)g / m_1+m_2$

Explanation:

Far the motion of both the blocks

$m_1a = T - \mu_k m_1 g$

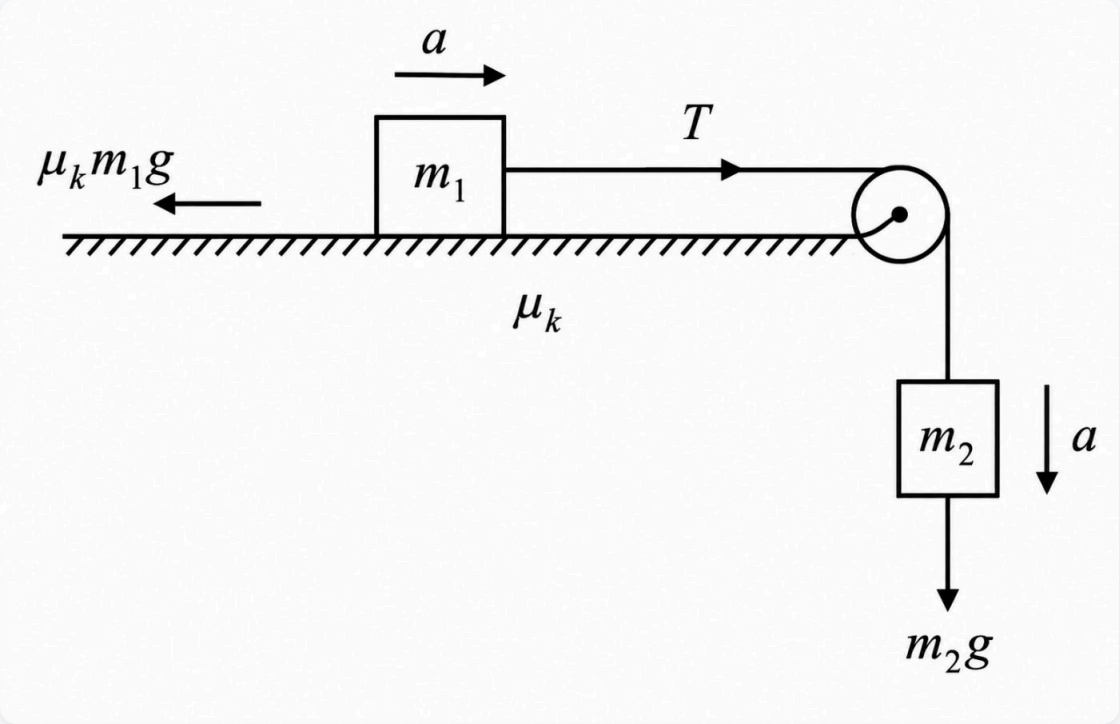
$m_2g - T = m_2a$

$a = m_2g - \mu_k m_1 g/m_1+m_2$

$m_2g - T = (m_2)(m_2g-\mu_k m_1 g) / m_1+m_2$

solving we get tension in the string

$T = m_1m_2(1+\mu_k m_1)g / m_1+m_2$



Question 141.

Two similar springs **P** and **Q** have spring constants K_P and K_Q, such that $K_P > K_Q$. They are stretched, first by the same amount (**case a**), then by the same force (**case b**). The work done by the springs, W_P and W_Q are related as, in **case (a)** and **case (b)**, respectively.

[4 Marks]

(A) $W_P = W_Q$; $W_P = W_Q$

(B) $W_p < W_Q$; $W_Q < W_p$

(C) $W_p > W_Q$; $W_Q > W_p$

(D) $W_p = W_Q$; $W_p = W_Q$

Explanation:

Case (a): Suppose the two springs are stretched by the same distance x. Then

$$\frac{W_P}{W_Q} = \frac{\frac{1}{2}k_P x^2}{\frac{1}{2}k_Q x^2} = \frac{k_P}{k_Q}$$

As $k_P > k_Q$, so, $W_P > W_Q$

Case (b): Suppose the two springs stretched by distance x_P and x_Q by the same force F.

Then,

$$F = k_P x_P = k_Q x_Q$$

$$\frac{W_P}{W_Q} = \frac{\frac{1}{2}k_P x_P^2}{\frac{1}{2}k_Q x_Q^2} = \frac{k_P \cdot x_P \cdot x_P}{k_Q \cdot x_Q \cdot x_Q} = \frac{F x_P}{F x_Q} = \frac{k_Q}{k_P}$$

As $k_P > k_Q \quad \therefore \quad W_Q > W_P$

Question 142.

A block of mass **10 kg**, moving in **x** direction with a constant speed of **10 ms^{-1}**, is subject to a retarding force F=0.1xJ/m during its travel from **x = 20 m** to **30 m**. Its final **KE** will be:

[4 Marks]

(A) 450 J

(B) 250 J

(C) 275 J

(D) 475 J

Explanation:

Given, m = 10 kg

u = 10 m/sec

Retarding force, F = $0.1x$ J/m

Acceleration, $a = \frac{F}{m}$

$$a = \frac{0.1x}{10} = 0.01x$$

From, $v^2 = u^2 - 2as$

$$\Rightarrow \quad v^2 = (10)^2 - 2 \times 0.01 \int_{20}^{30} x\,dx$$

$$\Rightarrow \quad v^2 = 100 - 0.02\left[\frac{x^2}{2}\right]_{20}^{30}$$

$$\Rightarrow \quad v^2 = 100 - \frac{0.02}{2}[(30)^2 - (20)^2]$$

$$\Rightarrow \quad v^2 = 100 - 0.01[900 - 400]$$

$$\Rightarrow \quad v^2 = 100 - 0.01[500]$$

$$\Rightarrow \quad v^2 = 95 \text{ m/sec}$$

Final K.E. = $\frac{1}{2}mv^2$

$$= \frac{1}{2} \times 10 \times 95 \Rightarrow 475 \text{ J}$$

Final K.E. = 475 J

Question 143.

A particle of mass **m** is driven by a machine that delivers a constant power of **k watts**. If the particle starts from rest, the force on the particle at time **t** is:

[4 Marks]

(A) $\sqrt{(mk/2)}\ t^{-1/2}$

(B) $1/2\ \sqrt{(mk)}\ t^{-1/2}$

(C) $\sqrt{(2mk)}\ t^{-1/2}$

(D) $\sqrt{(mk)}\ t^{-1/2}$

Explanation:

As we know power P = dw/dt

$w = Pt = 1/2mV^2$

So, $v = \sqrt{2Pt/m}$

Hence, acceleration $a = dV/dt = \sqrt{2P/m} \cdot 1/2\sqrt{t}$

Therefore, force on the particle at time 't'

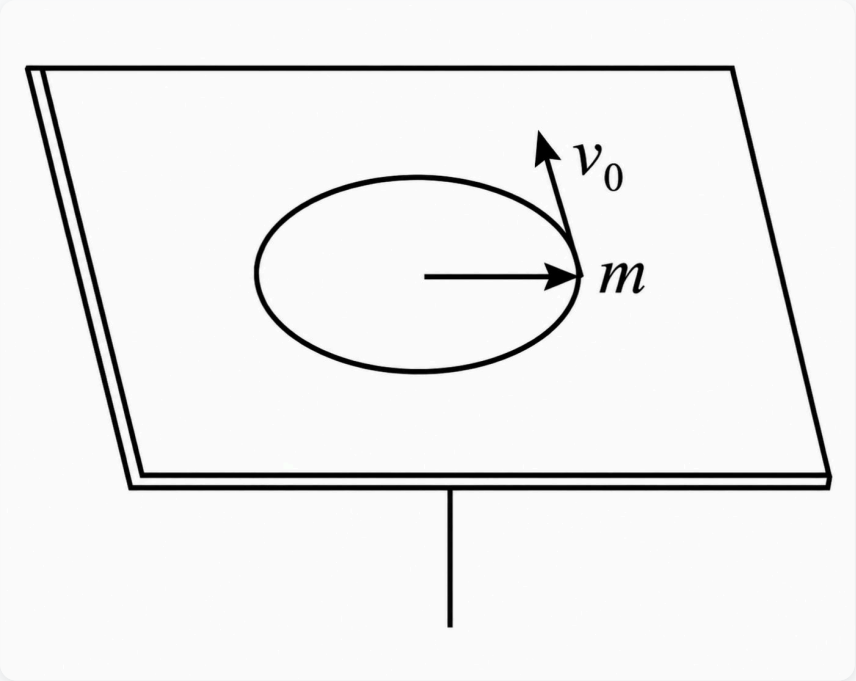
$= ma = \sqrt{2Km^2/m} \cdot 1/2\sqrt{t} = \sqrt{km/2t} = \sqrt{(mk/2)}\ t^{-1/2}$

Question 144.

A mass **m** moves in a circle on a smooth horizontal plane with velocity v_o at a radius R_o. The mass is attached to a string which passes through a smooth hole in the plane as shown.

The tension in the string is increased gradually and in a circle of radius $R_o/2$. The final value of the kinetic energy is

[4 Marks]



(A) $1/4\ mv_0^2$

(B) $2mv_o^2$

(C) $1/2\ mv_0^2$

(D) mv_0^2

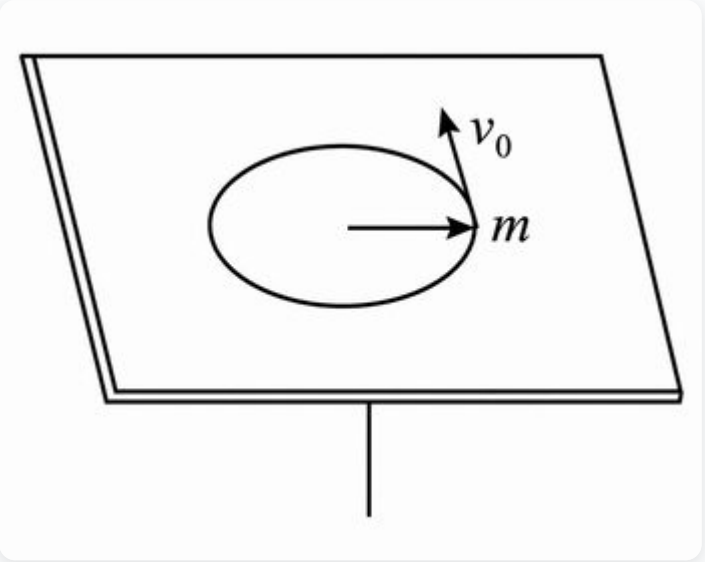
Explanation:

Applying angular momentum conservation

$mv_oR_o = (m)(v)(R_o/2)$

$v = 2v_o$

Therefore, final KE = $1/2\ m(2v_o)^2 = 2mv_o^2$



Question 145.

A rod of weight W is supported by two parallel knife edges A and Band is in equilibrium in a horizontal position. The Knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is

[4 Marks]

(A) Wx/d

(B) W(d-x)/d

(C) W(d-x)/x

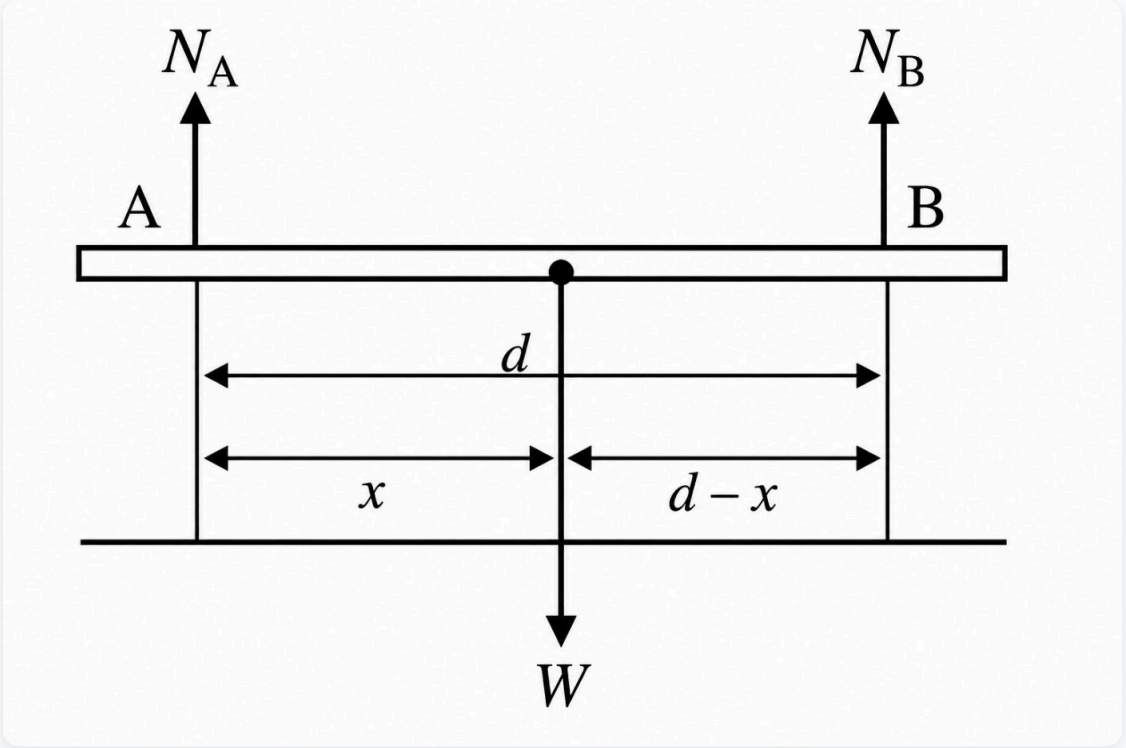
(D) Wd/x

Explanation:

By torque balancing about B

N_A(d) = W(d-x)

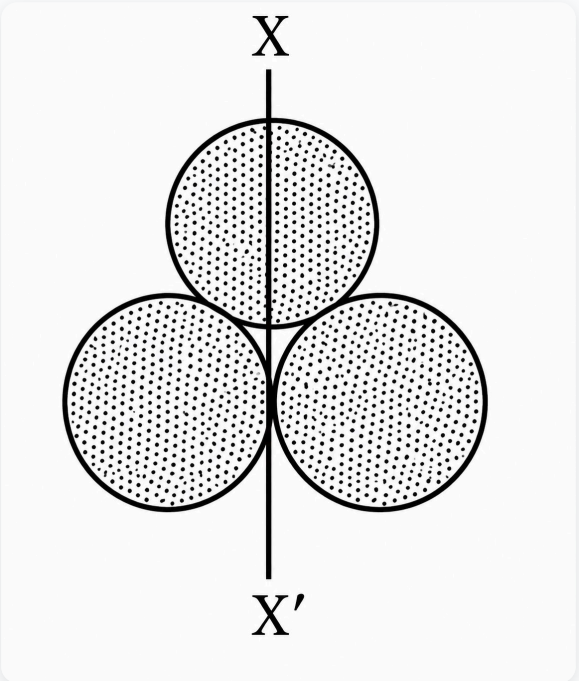
N_A = W(d-x)/d



Question 146.

Three identical spherical shells, each of mass m and radius rare placed as shown in figure. Consider an axis XX' which is touching to two shells and passing through diameter of third shell. Moment of inertia of the system consisting of these three spherical shells about XX' axis is

[4 Marks]



(A) $3mr^2$

(B) $16/5\ mr^2$

(C) $4mr^2$

(D) 11/5 mr^2

Explanation:

Moment of inertia of shell **1** along diameter, $I_{diameter} = 2/3Mr^2$

Moment of inertia of shell **2** = M.I. of shell **3**

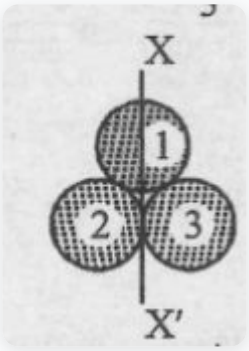
= $I_{tangential} = 2/3Mr^2 + Mr^2 = 35\ Mr^2$

So, I system along axis **XX′**

= $I_{diameter}$ + (Itangential) × 2

or, $I_{total} = 2/3Mr^2 + (5/3Mr^2)$ × 2

= 12/3 $Mr^2 = 4\ Mr^2$



Question 147.

Kepler's third law states that the square of the period of revolution (**T**) of a planet around the Sun is proportional to the third power of the average distance **r** between the Sun and the planet, i.e., $T^2 = Kr^3$ where **K** is constant. If the masses of the Sun and the planet are **M** and **m** respectively, then as per Newton's law of gravitation, the force of attraction between them is $F = GMm/r^2$ where **G** is the gravitational constant.

The relation between **G** and **K** is described as:

[4 Marks]

(A) $GMK = 4\pi^2$

(B) $GK = 4\pi^2$

(C) K = G

(D) K = 1/G

Explanation:

As we know, orbital speed, $v_{orb} = \sqrt{GM/r}$

Time period $T = 2\pi r/v_{orb} = 2\pi r/\sqrt{GM}.\sqrt{r}$

Squaring both sides

$T^2 = (2\pi r\sqrt{r}/\sqrt{GM})^2 = 4\pi^2/GM.r^3$

$\Rightarrow T^2/r^3 = 4\pi^2/GM = K$

$\Rightarrow GMK = 4\pi^2$

Question 148.

Two spherical bodies of mass **M** and **5M** having radii **R** and **2R** are released in free space with initial separation between their centres equal to **12R**. If they attract each other due to gravitational force only, then the distance covered by the smaller body before collision is:

[4 Marks]

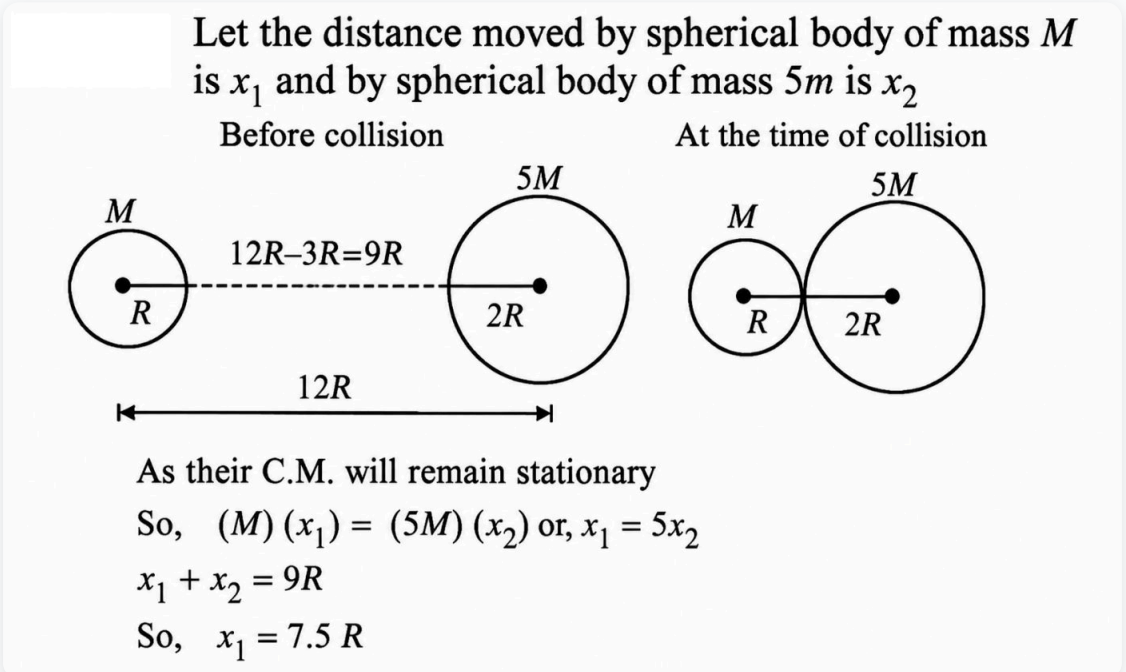
(A) 2.5R

(B) 1.5R

(C) 7.5R

(D) 4.5R

Explanation:



Question 149.

the approximate depth of an ocean is **2700 m**. The compressibility of water is 45.4×10^{-11} Pa^{-1} and the density of water is 10^3 kg/m^3. What fractional compression of water will be observed at the bottom of the ocean?

[4 Marks]

(A) 0.8×10^{-2}

(B) 1.4×10^{-2}

(C) 1.2×10^{-2}

(D) 1.0×10^{-2}

Explanation:

Compressibility of water,

$K = 45.4\times10^{-11}$ Pa^{-1}

density of water $P = 10^3$ kg/m^3

depth of ocean, h = 2700 m

We have to find $\Delta V/V$ = ?

As we know, compressibility,

$K = 1/B = (\Delta V/V)/P (P = \rho gh)$

So, $(\Delta V/V) = K\rho gh$

$= 45.4 \times 10^{-11} \times 10^3 \times 10 \times 2700 = 1.2258 \times 10^{-2}$

Question 150.

A wind with speed **40 m/s** blows parallel to the roof of a house. The area of the roof is **250 m^2**. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be (ρ_{air} = **1.2 kg/m^3**):

[4 Marks]

(A) 2.4×10^5 N, upwards

(B) 4.8×10^5 N, upwards

(C) 4.8×10^5 N, downwards

(D) 2.5 × 10^5 N, downwards

Explanation:

According to Bernoulli's theorem,

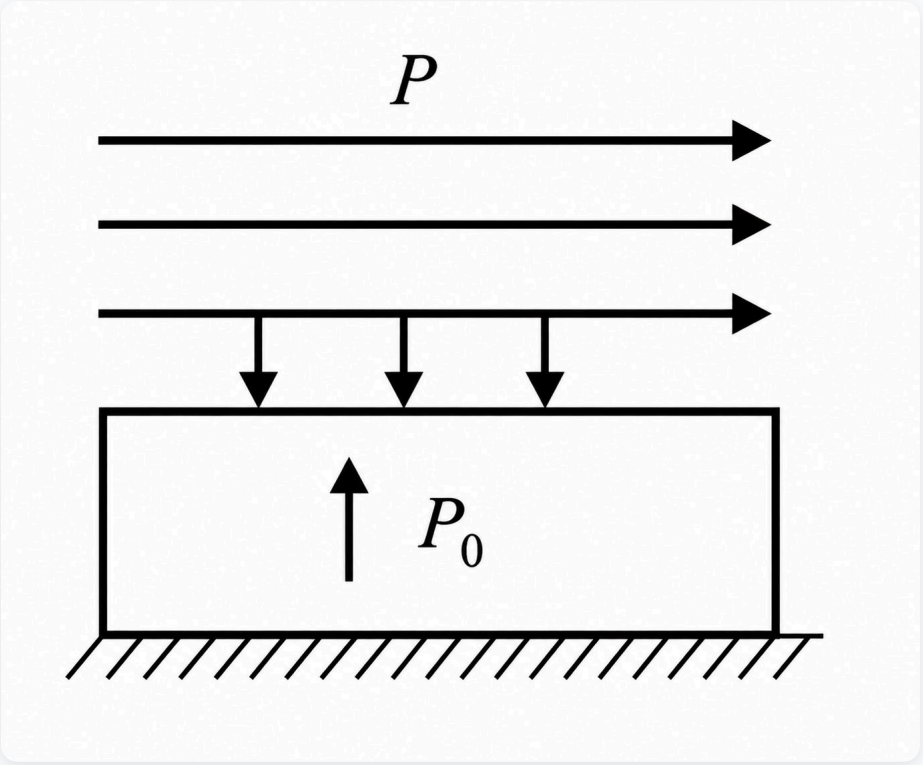
$P+1/2\rho v^2 = P_0+0$

So, $\Delta P = 1/2\rho v^2$

$F = \Delta PA = 1/2\rho v^2 A$

$= 1/2 \times 1.2 \times 40 \times 40 \times 250$

$= 2.4 \times 10^5$ N, upwards



Question 151.

On observing light from three different stars **P, Q** and **R**, it was found that the intensity of violet colour is maximum in the spectrum of **P**, the intensity of green colour is maximum in the spectrum of **R** and the intensity of red colour is maximum in the spectrum of **Q**. If **T_P, T_Q** and **T_R** are the respective absolute temperatures of **P, Q** and **R**, then it can be concluded from the above observations that:

[4 Marks]

(A) T_P < T_R < T_Q

(B) T_P > T_R > T_Q

(C) T_P < T_Q < T_R

(D) $T_P > T_Q > T_R$

Explanation:

From Wien's displacement law,

$\lambda_m \times T$ = constant

P – max intensity is at **violet**

⇒ λ_m is minimum

⇒ temp maximum

R – Max. intensity is at **green**

⇒ λ_m is moderate

⇒ Temp moderate

Q – Max. intensity is at **red**

⇒ λ_m is maximum

⇒ Temp. is minimum

i.e., $T_P > T_R > T_Q$

Question 152.

The two ends of a metal rod are maintained at temperatures **100°C** and **110°C**. The rate of heat flow in the rod is found to be **4.0 J/s**. If the ends are maintained at temperatures **200°C** and **210°C**, the rate of heat flow will be:

[4 Marks]

(A) 16.8 J/s

(B) 8.0 J/s

(C) 4.0 J/s

(D) 44.0 J/s

Explanation:

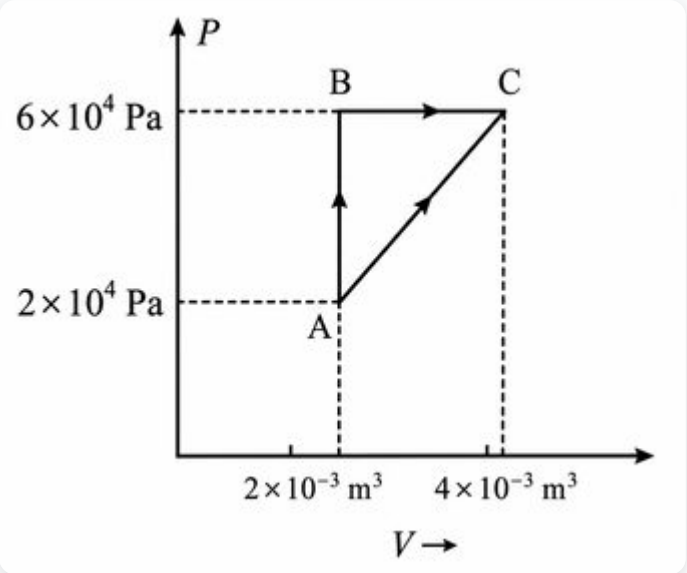
As the temperature difference ΔT =10°C as well the thermal resistance is same for both the cases, so thermal current or rate of heat flow will also be same for both the cases.

Question 153.

Figure below shows two paths that may be taken by a gas to go from a state A to a state C.

In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be

[4 Marks]



(A) 380 J

(B) 300 J

(C) 500 J

(D) 460 J

Explanation:

As the temperature difference ΔT =10°C as well the thermal resistance is same for both the cases, so thermal current or rate of heat flow will also be same for both the cases.

In cyclic process ABCA

$$Q_{cycle} = W_{cycle}$$

$$Q_{AB} + Q_{BC} + Q_{CA} = \text{ar. of } \Delta ABC$$

$$+400 + 100 + Q_{C\to A} = \frac{1}{2}(2\times 10^{-3})(4\times 10^{4})$$

$$\Rightarrow \quad Q_{C\to A} = -460\ \text{J} \quad \Rightarrow \quad Q_{A\to C} = +460\ \text{J}$$

Question 154.

A Carnot engine having an efficiency of **1/10** as heat engine, is used as a refrigerator. If the work done on the system is **10 J**, the amount of energy absorbed from the reservoir at lower temperature is:

[4 Marks]

(A) 90 J

(B) 99 J

(C) 100 J

(D) 1 J

Explanation:

Given, efficiency of engine, η = 1/10

work done on system W =10J Coefficient of performance of refrigerator

$\beta = Q_2/W = 1-\eta/\eta = 1-1/10 \,/\, 1/10 = 9/10 \,/\, 1/10 = 9$

Energy absorbed from reservoir

$Q_2 = \beta W$

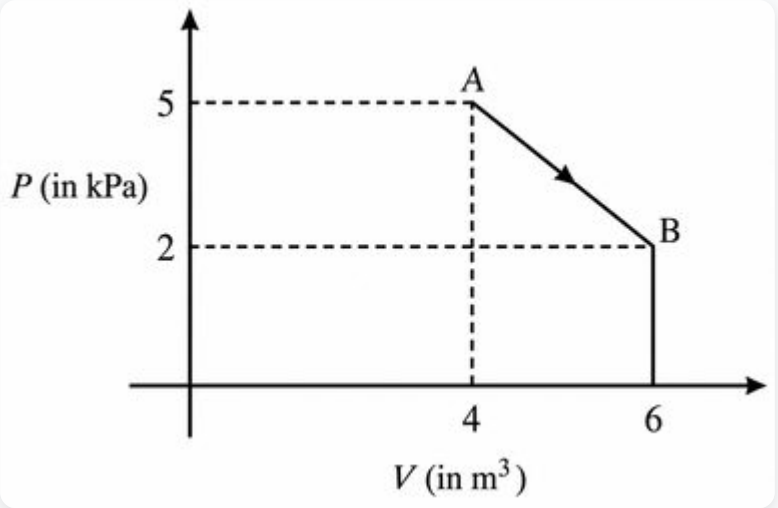
$Q_2 = 9 \times 10 = 90$ J

Question 155.

One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure.

The change in internal energy of the gas during the transition is:

[4 Marks]



(A) - 12 kJ

(B) 20 kJ

(C) 20 J

(D) - 20 kJ

Explanation:

Given, efficiency of engine, η = 1/10

work done on system W =10J Coefficient of performance of refrigerator

$\beta = Q_2/W = 1-\eta/\eta = 1-1/10 / 1/10 = 9/10 / 1/10 = 9$

Energy absorbed from reservoir

$Q_2 = \beta W$

$Q_2 = 9 \times 10 = 90$ J

Change in internal energy from $A \rightarrow B$

$$\Delta U = \frac{f}{2} nR\Delta T = \frac{f}{2} nR\,(T_f - T_i)$$

$$= \frac{5}{2}\{P_f V_f - P_i V_i\}$$

$$= \frac{5}{2}\{2 \times 10^3 \times 6 - 5 \times 10^3 \times 4\}$$

$$= \frac{5}{2}\{12 - 20\} \times 10^3\,J = 5 \times (-4) \times 10^3\,J$$

$$\Delta U = -20\,KJ$$

Question 156.

The ratio of the specific heats $C_p/C_v = \gamma$ in terms of degrees of freedom (**n**) is given by:

[4 Marks]

(A) (1+n/2)

(B) (1+1/n)

(C) (1+n/3)

(D) (1+2/n)

Explanation:

Let 'n' be the degree of freedom

$\gamma = C_p/C_v = (n/2 + 1)R / (n/2)R = (1+2/n)$

Question 157.

When two displacements represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are super-imposed, the motion is:

[4 Marks]

(A) Simple harmonic with amplitude a/b

(B) Simple harmonic with amplitude $\sqrt{a^2+b^2}$

(C) Simple harmonic with amplitude a+b/2

(D) Not a simple harmonic.

Explanation:

The two displacement equations are

$y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t) = b\sin(\omega t+\pi/2)$

$y_eq = y_1+y_2$

$= a\sin\omega t + b\cos\omega t$

$= a\sin\omega t + b\sin(\omega t+\pi/2)$

Since the frequencies for both SHMs are same, the resultant motion will be **SHM**.

Now, the amplitude,

$A_eq = \sqrt{(a^2 + b^2 + 2\,ab\cos \pi/2)}$

$\Rightarrow A_eq = \sqrt{(a^2 + b^2)}$

Question 158.

A particle is executing **SHM** along a straight line. Its velocities at distances $\mathbf{x_1}$ and $\mathbf{x_2}$ from the mean position are $\mathbf{V_1}$ and $\mathbf{V_2}$, respectively. Its time period is:

[4 Marks]

(A) $2\pi\sqrt{(x^2_2-x_1^2/V_1^2-V^2_2)}$

(B) $2\pi\sqrt{(V_1^2+V^2_2/x_1^2+x^2_2)}$

(C) $2\pi\sqrt{(V_1^2-V^2_2/x_1^2-x^2_2)}$

(D) $2\pi\sqrt{(x_1^2-x^2_2/V_1^2-V^2_2)}$

Explanation:

As we know, for particle undergoing SHM,

$$V = \omega\sqrt{A^2 - X^2}$$

$$V_1^2 = \omega^2 (A^2 - x_1^2)$$

$$V_2^2 = \omega^2 (A^2 - x_2^2)$$

Subtracting we get,

$$\frac{V_1^2}{\omega^2} + x_1^2 = \frac{V_2^2}{\omega^2} + x_2^2$$

$$\Rightarrow \frac{V_1^2 - V_2^2}{\omega^2} = x_2^2 - x_1^2$$

$$\Rightarrow \omega = \sqrt{\frac{V_1^2 - V_2^2}{x_2^2 - x_1^2}}$$

$$\Rightarrow T = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$$

Question 159.

The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is

[4 Marks]

(A) 80 cm

(B) 120 cm

(C) 140 cm

(D) 100 cm

Explanation:

Fundamental frequency of closed organ pipe,

$v_c = v/4l_c$

Fundamental frequency of open organ pipe

$v_o = v/2l_o$

Second overtone frequency of open organ pipe = $3v/2l_o$

From question, $v/4l_c = 3v/2l_o$

$l_o = 6l_c = 6 \times 20 = 120$ cm

Question 160.

A parallel plate air capacitor of capacitance **C** is connected to a cell of emf **V** and then disconnected from it. A dielectric slab of dielectric constant **K**, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect?

[4 Marks]

(A) The change in energy stored is 1/2 $CV^2(1/K-1)$

(B) The energy stored in the capacitor decreases K times.

(C) The charge on the capacitor is not conserved.

(D) The potential difference between the plates decreases K times.

Explanation:

Capacitance of the capacitor, C = Q/V

After inserting the dielectric, new capacitance C' = K.C

New potential difference

V' = V/K

$U_i = 1/2CV^2 = Q^2/2C$ (Q = CV)

$U_f = Q^2/2C = Q^2/2KC = C^2V^2/2KC = (U_i/K)$

$\Delta U = U_f - U_i = 1/2CV^2(1/K - 1)$

As the capacIitor is isolated, so charge will remain conserved and p.d. between two plates of the capacitor

V' = Q/KC = V/K

Question 161.

Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is:

[4 Marks]

(A) Current

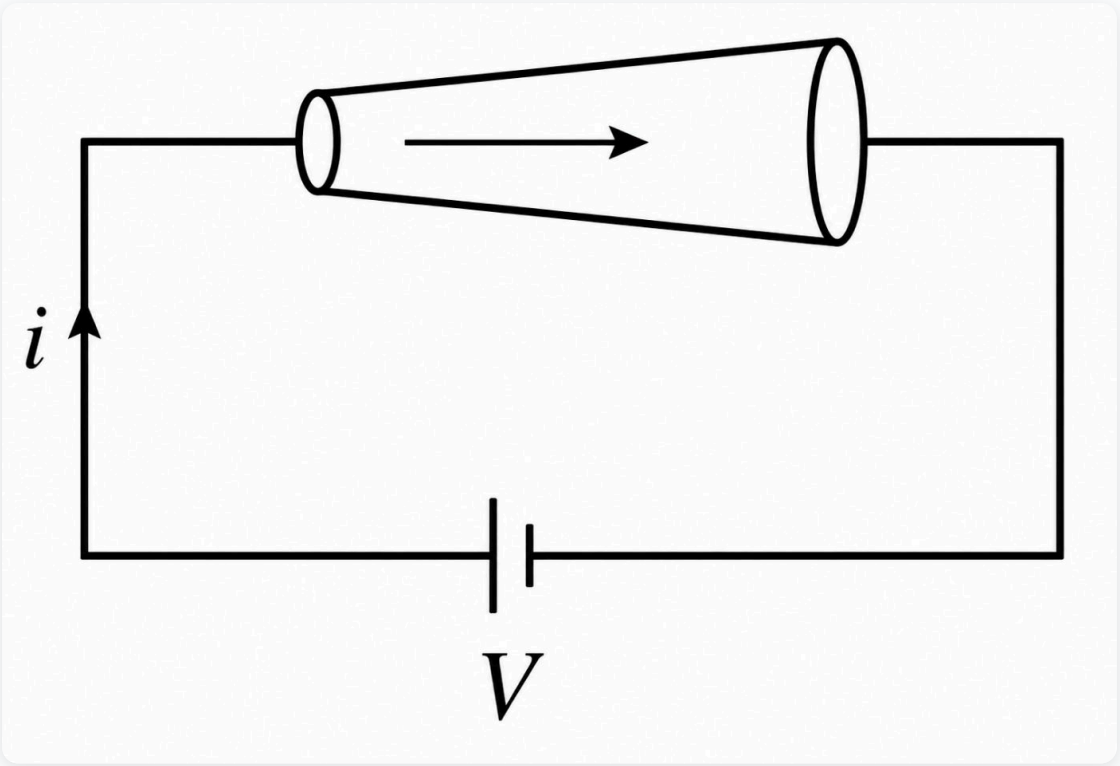
(B) Drift velocity

(C) Electric field

(D) Current density

Explanation:

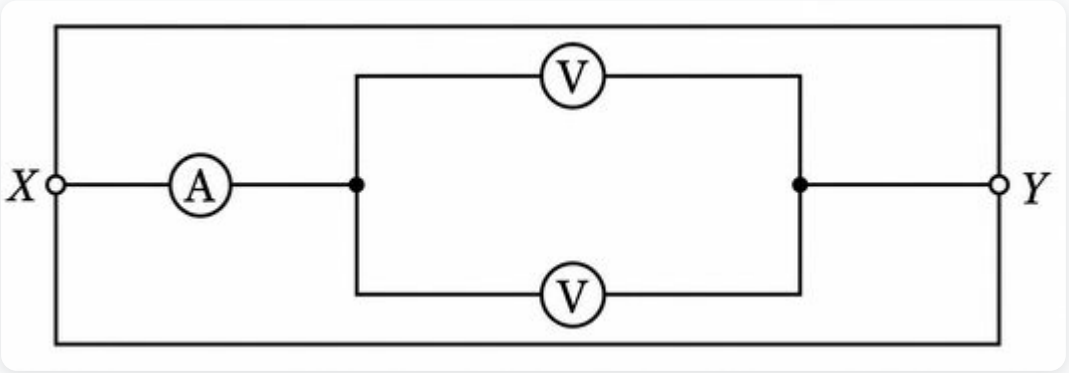
Here, metallic conductor can be considered as the combination of various conductors connected in series. And in series combination current remains same.



Question 162.

A, B and **C** are voltmeters of resistance **R**, **1.5R** and **3R** respectively as shown in the figure. When some potential difference is applied between **X** and **Y**, the voltmeter readings are **V_A**, **V_B** and **V_C** respectively. Then:

[4 Marks]



(A) V_A ≠ V_B ≠ V_C

(B) V_A = V_B = V_C

(C) V_A = V_B ≠ V_C

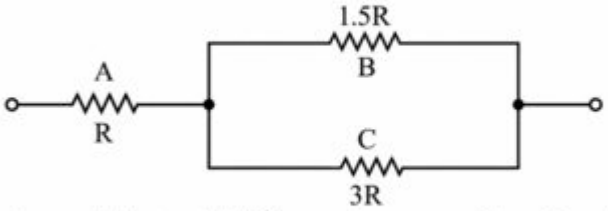
(D) V_A ≠ V_B = V_C

Explanation:

Effective resistance of B and C

$$\frac{R_B \cdot R_C}{R_B + R_C} = \frac{1.5R \times 3R}{1.5R + 3R} = \frac{4.5R^2}{4.5R} = R$$

i.e., equal to resistance of voltmeter A.



In parallel potential difference is same so, $V_B = V_C$ and in series current is same

So, $V_A = V_B = V_C$.

Hence, the reading of all the three voltmeters are same.

Question 163.

A potentiometer wire has length 4 m and resistance 8 Ω. The resistance that must be connected in series with the wire and accumulator of e.m.f. 2 V, so as to get a potential gradient 1 mV per cm on the wire is:

[4 Marks]

(A) 40 Ω

(B) 44 Ω

(C) 48 Ω

(D) 32 Ω

Answer:

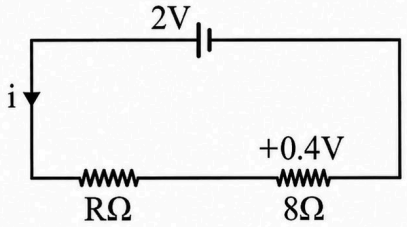
Total potential difference across potentiometer wire

$= 10^{-3} \times 400 \text{ volt} = 0.4 \text{ volt}$

$\text{potential gradient} = \frac{1\text{mv}}{\text{cm}}$

$= 10^{-3} \text{ v/cm} = 10^{-1} \frac{\text{v}}{\text{m}}$

Let resistance of RΩ connected in series.



$\text{So, } \frac{2}{R+8} = \frac{10^{-1} \times 4}{8} = \frac{1}{20}$

$\Rightarrow \quad R + 8 = 40 \quad \text{or,} \quad R = 32\ \Omega$

Question 164.

An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude:

[4 Marks]

(A) Zero

(B) $\mu_0 n^2 e/r$

(C) $\mu_0 ne/2r$

(D) $\mu_0 ne/2\pi r$

Explanation:

Radius of circular orbit = **r**

No. of rotations per second = **n**

i.e., T = 1/n

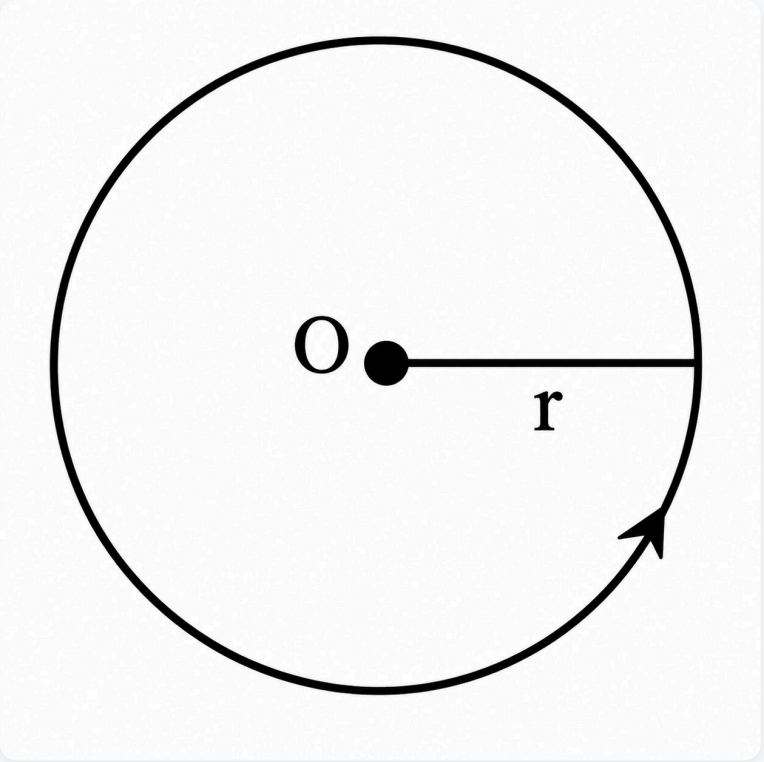
Magnetic field at its centre, B_c = ?

As we know, current

i = e/T = e/(1/n) = en = equivalent current

Magnetic field at the centre of circular orbit,

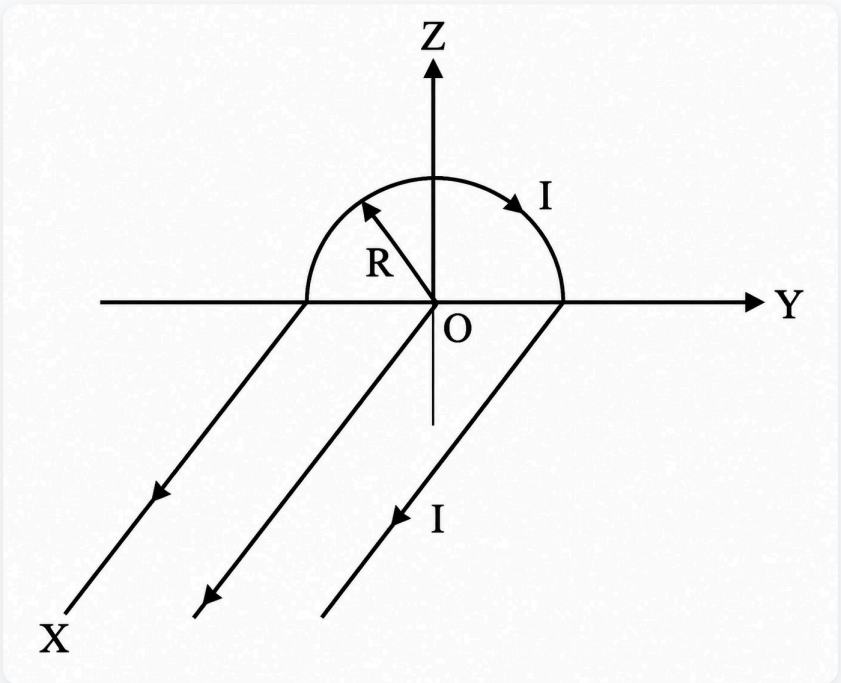
$B_c = \mu_0 i/2r = \mu_0 ne/2r$



Question 165.

A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane. Mngnetic field at point O is

[4 Marks]



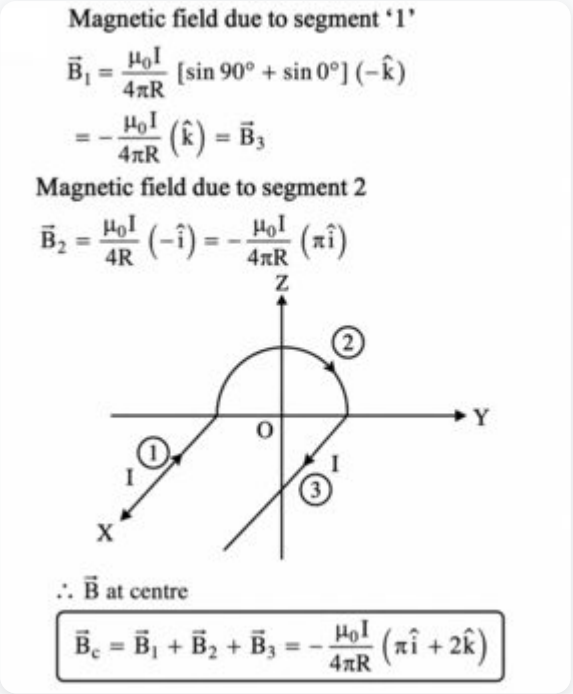
(A) □□ = $-\mu_0/4\pi.I/R(\mu\hat{i} \times 2\hat{k})$

(B) □□ = $-\mu_0/4\pi.I/R(\pi\hat{i} + 2\hat{k})$

(C) □□= $\mu_0/4\pi.I/R(\pi\hat{i} + 2\hat{k})$

(D) □□= $\mu_0/4\pi.I/R(\pi\hat{i} - 2\hat{k})$

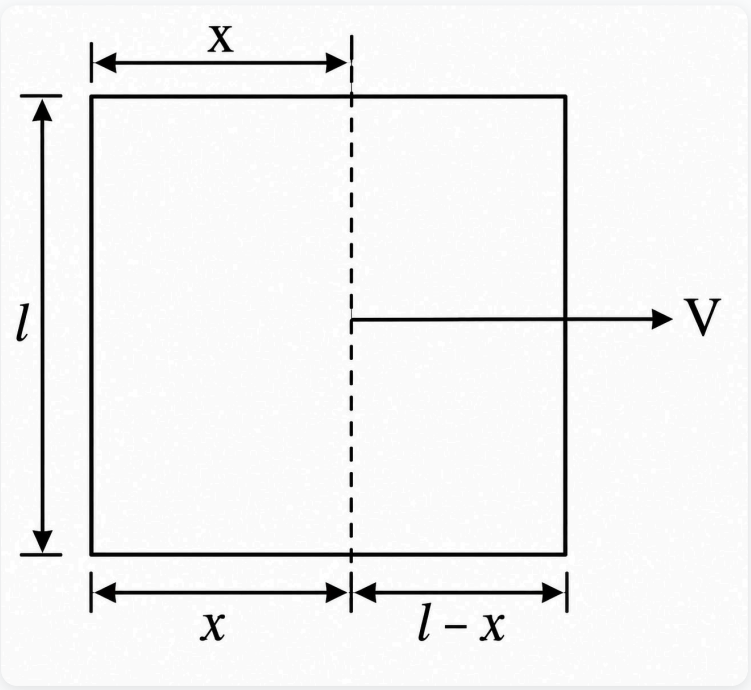
Explanation:



Question 166.

A conducting square frame of side 'a' and a long straight wire carrying current III are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity V. The emf induced in the frame will be proportional to:

[4 Marks]



(A) $1/x^2$

(B) 1/(2x-a)(2x+a)

(C) $1/(2x-a)^2$

(D) $1/(2x+a)^2$

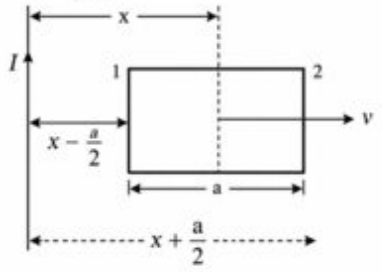
Explanation:

Emf induced in side 1 of frame $e_1 = B_1 V\ell$

$$B_1 = \frac{\mu_0 I}{2\pi\left(x - \frac{a}{2}\right)}$$

Emf induced in side 2 of frame $e_2 = B_2 V\ell$

$$B_2 = \frac{\mu_0 I}{2\pi\left(x + \frac{a}{2}\right)}$$



Emf induced in square frame

$$e = B_1 V\ell - B_2 V\ell$$

$$= \frac{\mu_0 I}{2\pi\left(x - \frac{a}{2}\right)} \ell V - \frac{\mu_0 I}{2\pi\left(x + \frac{a}{2}\right)} \ell V$$

$$\text{or, } e \propto \frac{1}{(2x - a)(2x + a)}$$

Question 167.

A resistance **R** draws power **P** when connected to an AC source. If an inductance is now placed in series with the resistance, such that the impedance of the circuit becomes **Z**, the power drawn will be:

[4 Marks]

(A) $P(R/Z)^2$

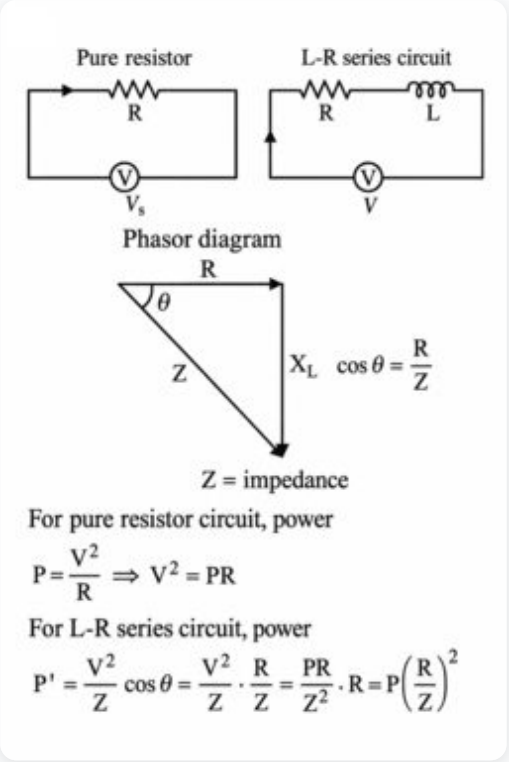
(B) P

(C) $P\sqrt{R/Z}$

(D) P(R/Z)

Explanation:

.



Question 168.

A radiation of energy **E** falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (**C** = velocity of light).

[4 Marks]

(A) 2E/C

(B) E/C^2

(C) $2E/C^2$

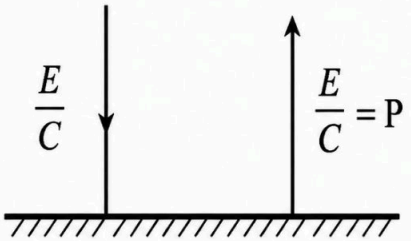
(D) E/C

Explanation:

.

Momentum of light falling on reflecting surface $p = \frac{E}{C}$

As surface is perfectly reflecting so momentum reflect $p' = -\frac{E}{C}$



So, momentum transferred

$$= P - P' = \frac{E}{C} - \left(-\frac{E}{C}\right) = \frac{2E}{C}$$

Question 169.

Two identical thin plano-convex glass lenses (refractive index **1.5**) each having radius of curvature of **20 cm** are placed with their convex surfaces in contact at the centre. The intervening space is filled with oil of refractive index **1.7**. The focal length of the combination is:

[4 Marks]

(A) −25 cm

(B) −50 cm

(C) 50 cm

(D) -20 cm

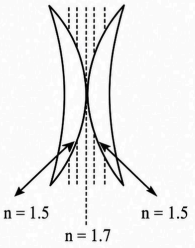
Answer:

Using lens maker's formula,

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\Rightarrow \frac{1}{f_1} = \left(\frac{1.5}{1} - 1\right)\left(\frac{1}{\infty} - \frac{1}{-20}\right)$$

$$\Rightarrow f_1 = 40\ \text{cm}$$



$$\Rightarrow \frac{1}{f_2} = \left(\frac{1.7}{1} - 1\right)\left(\frac{1}{-20} - \frac{1}{+20}\right)$$

$$\Rightarrow f_2 = -\frac{100}{7}\ \text{cm}$$

Similarly,

$$\Rightarrow \frac{1}{f_3} = \left(\frac{1.5}{1} - 1\right)\left(\frac{1}{\infty} - \frac{1}{-20}\right)$$

$$\Rightarrow f_3 = 40\ \text{cm}$$

Now according to the condition

$$\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$$

$$\Rightarrow \frac{1}{f_{eq}} = \frac{1}{40} + \frac{1}{-\frac{100}{7}} + \frac{1}{40}$$

$$\therefore \quad f_{eq} = -50\ \text{cm}$$

Therefore, the focal length of the combination is − 50 cm.

Question 170.

The refracting angle of a prism is **A**, and the refractive index of the material of the prism is **cot (A/2)**. The angle of minimum deviation is:

[4 Marks]

(A) 90°- A

(B) 180°+ 2A

(C) 180°- 2A

(D) 180°- 3A

Explanation:

As we know, the refractive index of the material of the prism

$$\mu = \frac{\sin\left(\frac{\delta_m + A}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\cot A/2 = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\frac{A}{2}} = \frac{\cos(A/2)}{\sin(A/2)} \qquad [\because \mu = \cot(A/2)]$$

$$\Rightarrow \sin\left(\frac{\delta_m + A}{2}\right) = \sin(90° + A/2)$$

$$\Rightarrow \frac{\delta_m + A}{2} = 90° + A/2$$

$$\Rightarrow \delta_m = 180° - 2A$$

i.e., Minimum deviation occurs between two slits.

Question 171.

In a double slit experiment, the two slits are **1 mm** apart and the screen is placed **1 m** away. A monochromatic light of wavelength **500 nm** is used. What will be the width of each slit for obtaining **ten maxima** on the double slit within the central maxima of single slit pattern?

[4 Marks]

(A) 0.2 mm

(B) 0.5 mm

(C) 0.02 mm

(D) 0.1 mm

Explanation:

Here,

Distance between the two slits,

$d = 1\ mm = 10^{-3}\ m$

Distance of the screen from the slits, D=1m

Wavelength of monochromatic light used,

$\lambda = 500\ nm = 500 \times 10^{-9}\ m$

Width of each slit, a = ?

Width of central maxima in single slit pattern = 2λD/a

Fringe width in double slit experiment, β = λD/d

So, the required condition,

10λD/d = 2λD/a

⇒ a = d/5D = 1/5 × 10^{-3} m =0.2 mm

Question 172.

For a parallel beam of monochromatic light of wavelength **λ**, diffraction is produced by a single slit whose width **'a'** is the wavelength of the light. If **D** is the distance of the screen from the slit, the width of the central maximum will be:

[4 Marks]

(A) 2Dλ/a

(B) Da/λ

(C) Dλ/a

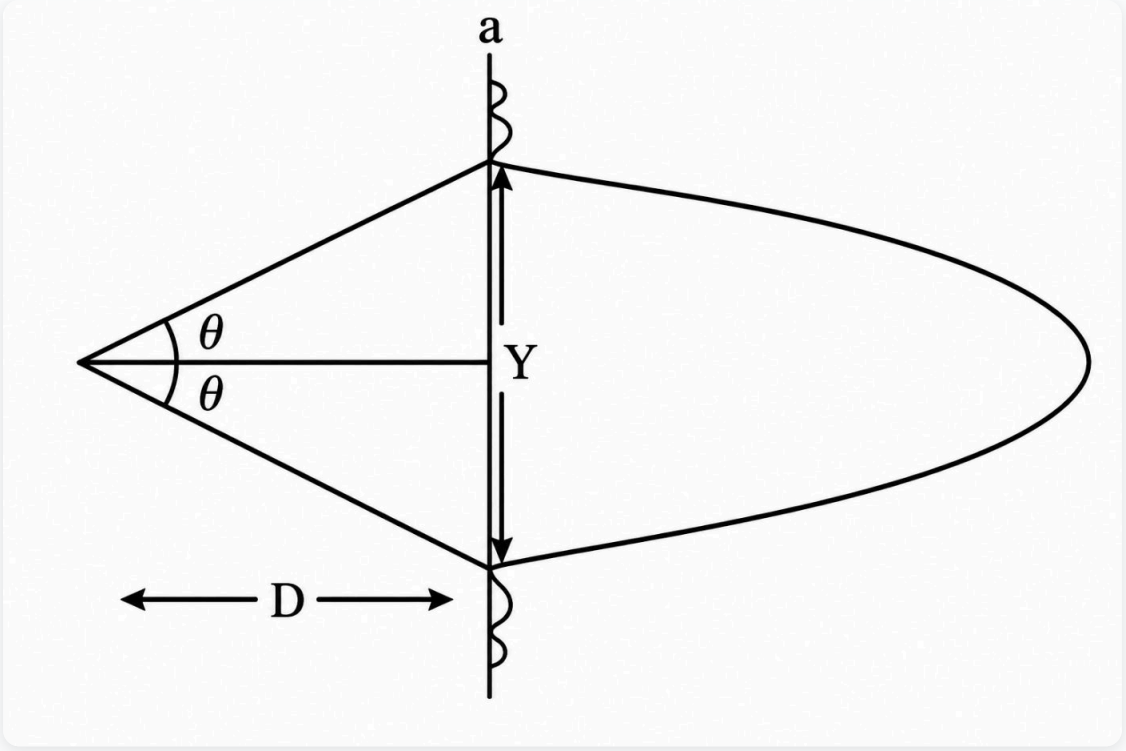
(D) 2Da/λ

Explanation:

Linear width of central maxima,

Y = D (2θ) = 2Dθ = 2Dλ/a

∴ θ = λ/a

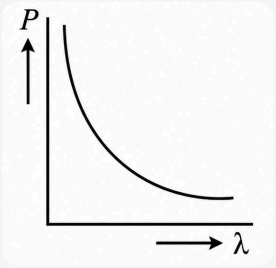


Question 173.

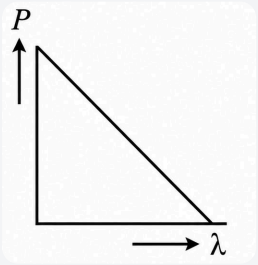
Which of the following figures represents the variation of particle momentum and the associated de-Broglie wavelength?

[4 Marks]

(A)



(B)



(C)



(D)



Explanation:

According to de-Broglie,

$p = h/\lambda$

or

$P \propto 1/\lambda$

where,

P = particle momentum

λ = de-Broglie wavelength

h = Planck's constant

$P \propto 1/\lambda$ represents a **rectangular hyperbola**.

Question 174.

A certain metallic surface is illuminated with monochromatic light of wavelength λ. The stopping potential for photo-electric current for this light is $3V_0$. If the same surface is illuminated with light of wavelength 2λ, the stopping potential is V_0. The threshold wavelength for this surface for photo-electric effect is:

[4 Marks]

(A) 6λ

(B) λ/4

(C) λ/6

(D) 4λ

Explanation:

As we know,

$eV_s = hc/\lambda - \Psi$

$3eV_0 = hc/\lambda - \Psi$...(i)

$eV_0 = hc/2\lambda - \Psi$...(ii)

$3eV_0 = 3hc/2\lambda - 3\Psi$...(iii)

Multiplying eqn. (ii) by (iii) and subtracting it from eqn. (i),

$\Psi = hc/4\lambda$

So, threshold wavelength,

$\lambda_{th} = hc/\Psi = hc/hc/4\lambda = 4\lambda$

Question 175.

Consider 3rd orbit of He^+ (Helium), using non-relativistic approach, the speed of electron in this orbit will be given K = 9×10^9 constant, Z = 2 and h (Planck's Constant) = 6.6×10^{-34} J s

[4 Marks]

(A) 2.92×10^6 m/s

(B) 3.0×10^8 m/s

(C) 0.73×10^6 m/s

(D) 1.46×10^6 m/s

Explanation:

Speed of electron in nth orbit

$V_n = 2\pi KZe^2/nh$

or $v = (2.19 \times 10^6 \text{ m/s})Z/n$

$v = (2.19 \times 10^6) \times 2/3$

(Z = 2 and n = 3)

$v = 1.46 \times 10^6 6$ m/s.

Question 176.

Two particles masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absorbing energy ε. If final velocities of be v_1 and v_2 then we must have

[4 Marks]

(A) $m_1u_1^2 + m_2u_2^2 - \varepsilon = m_1v_1^2 + mv_2^2$

(B) $1/2m_1u_1^2 + 1/2m_2u_2^2 + \varepsilon = 1/2m_1v_1^2 + 1/2mv_2^2$

(C) $1/2m_1u_1^2 + 1/2m_2u_2^2 - \varepsilon = 1/2m_1v_1^2 + 1/2mv_2^2$

(D) $1/2m_1u_1^2 + 1/2m_2u_2^2 = 1/2m_1v_1^2 + 1/2mv_2^2 - \varepsilon$

Explanation:

By law of conservation of energy,

K.E _f = K.E$_i$ − excitation energy (ε)

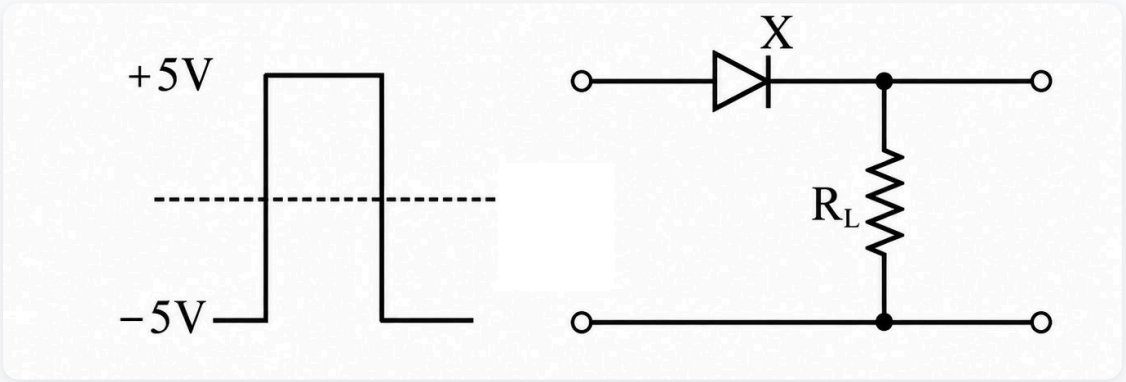
or

$1/2m_1u_1^2 + 1/2m_2u_2^2 - \varepsilon = 1/2m_1v_1^2 + 1/2mv_2^2$

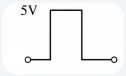
Question 177.

If in a p–n junction, a square input signal of 10 V is applied as shown, then the output across R_L will be …

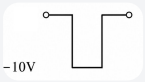
[4 Marks]



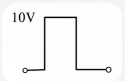
(A)



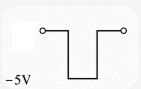
(B)



(C)



(D)



Explanation:

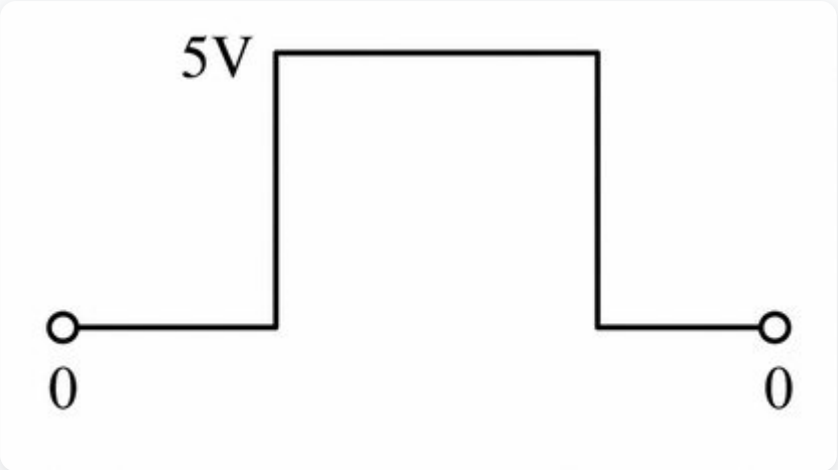
Here P-N junction diode rectifies half of the AC wave, i.e., acts as **half wave rectifier**.

During **+ve half cycle**

Diode → **forward biased**, output across will be:

During **−ve half cycle**

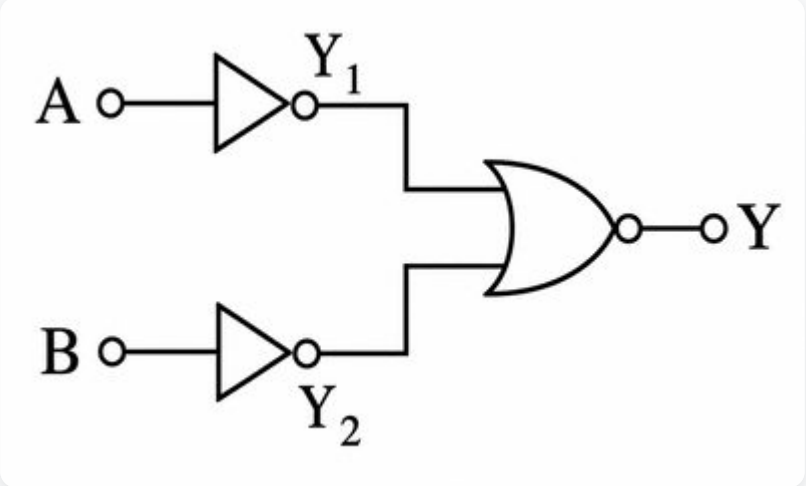
Diode → **reverse biased**, output will not be obtained.



Question 178.

Which logic gate is represented by the following combination of logic gate?

[4 Marks]



(A) OR

(B) NOR

(C) AND

(D) NAND

Explanation:

First two gates are NOT gates and the last gate is NOR gate.

Thus,

$Y_1 = \overline{A}$, $Y_2 = \overline{B}$

and

$Y = \overline{Y}_1 + \overline{Y}_2$

The truth table corresponding to this is as follows:

Thus the combination of gate represents **AND gate**.

A	B	$Y_1 = \overline{A}$	$Y_2 = \overline{B}$	$Y_1 + Y_2$	$Y = \overline{Y_1 + Y_2}$	A . B
0	0	1	1	1	0	0
0	1	1	0	1	0	0
1	0	0	1	1	0	0
1	1	0	0	0	1	1

Question 179.

The electric field in a certain region is acting radially outward and is given by

E = Aa. A charge contained in a sphere of radius **'a'** centred at the origin of the field, will be

[4 Marks]

(A) $\varepsilon_0 Aa^3$

(B) $4\pi\varepsilon_0 Aa^2$

(C) $4\pi\varepsilon_0 Aa^3$

(D) $A\varepsilon_0 a^2$

Explanation:

Net flux emitted from a spherical surface of radius a according to Gauss's theorem

$\Phi_{net} = q_{in}/\varepsilon_0$

or $(Aa)(4\pi a^2) = q_{in}/\varepsilon_0$

So, $q_{in} = 4\pi\varepsilon_0 Aa^3$

Question 180.

If radius of the $^{27}_{12}Al$ nucleus is taken to be R_Al, then radius of $^{125}_{53}Te$ nucleus is nearly:

[4 Marks]

(A) $(53/13)^{1/3}$R_Al

(B) $(13/53)^{1/3}$R_Al

(C) 5/3R_Al

(D) 3/5R_Al

Explanation:

As we know,

$R = R_0(A)^{1/3}$

where A = mass number.

$R_Al = R_0(27)^{1/3} = 3R_0$

$R_Te = R_0(125)^{1/3}$ 1/3 $= 5R_0 = 5/3R_Al$