

Botany - Section A

1. In a terrestrial ecosystem, the abiotic factors that have most effect on its primary productivity will be:

1. light and nutrients
2. light and moisture
3. temperature and moisture
4. temperature and nutrients

2. Which of the following is probably the most economically important plant-parasitic nematode species among the tropical and subtropical regions?

1. *Meloidogyne incognita*
2. *Coenorhabditis elegans*
3. *Heterodera glycines*
4. *Arthrobotrys dactyloides*

3. Match each item in Column I with one in Column II and select the correct match from the codes given:

COLUMN I	COLUMN II
A Standing crop	P Mass of living material at each trophic level at a particular time
B Standing state	Q The amount of nutrients present in the soil at any given time
C Net primary productivity	R The rate of formation of new organic matter by consumers
D Secondary productivity	S Available biomass for the consumption to heterotrophs

Codes:

- A B C D
1. S P Q R
 2. P Q R S
 3. P Q S R
 4. R P Q S

4. To isolate DNA from a cell, the cell wall needs to be broken. Match the enzymes in Column I with the type of cell in Column II and select the correct match from the codes given:

Column I	Column II
A Lysozyme	P Fungal cell
B Cellulase	Q Plant cell
C Chitinase	R Bacterial cell

Codes

- A B C
1. P Q R
 2. P R Q
 3. R P Q
 4. R Q P

5. Ecology can be best described as:

1. the study of living things.
2. the study of non-living things.
3. the study of environmental factors.
4. the study of ecosystems.

6. *Calotropis* are avoided by the grazing herbivores because they produce:

1. stipules
2. thorns
3. mustard oils
4. cardiac glycosides

7. *Eichhornia crassipes*, *Parthenium hysterophorus* and *Lantana camara* are:

1. native species of India
2. critically endangered plants of India
3. invasive plant species
4. medicinal plants

8. The organisms first to colonize a bare rock, during ecological succession, are:

1. Annual plants
2. Lichens
3. Mycorrhiza
4. Green algae

9. Match plant diseases given in Column I with causative pathogens in Column II and select the correct match from the codes given:

COLUMN I	COLUMN II
A Brown rust of wheat	P Colletotrichum falcatum
B Black rot of crucifers	Q Xanthomonas campestris
C Red rot of sugarcane	R Phytophthora infestans
D Late blight of potato	S Puccinia graminis

Codes:

- A B C D
1. S Q P R
 2. S Q R P
 3. S R P Q
 4. R Q R S

10. After the primary producer level in an ecosystem:

1. less and less amount of new chemical energy is added at successive trophic levels
2. no new chemical energy is added at successive trophic levels
3. more and more amount of new chemical energy is added at successive trophic levels
4. less amount of new chemical energy is added at primary consumer level and then the amount of new chemical energy added to successive levels becomes more and more

11. Identify the incorrectly matched row:

Variety	Crop	Resistant to
1. Himgiri	Wheat	Leaf and stripe rust
2. Pusa sadabahar	Chilli	Chilli mosaic virus
3. Pusa Komal	Flat bean	Bacterial blight
4. Pusa sawani	Okra	Shoot and fruit borer

12. Match the sources of SCP in column I with their class in Column II and select the correct match from the codes given:

COLUMN I	COLUMN II
A Methylophilus methylotropus	P Blue green alga
B Fusarium venenatum	Q Bacteria
C Spirulina	R Fungus

Codes:

- A B C
1. Q P R
 2. Q R P
 3. P R Q
 4. R Q P

13. Which of the following is called as the "bee orchid" due to the flowers resembling the furry bodies of bees?

1. Epidendrum secundum
2. Vanilla planifolia
3. Ophrys apifera
4. Dactylorhiza sambucina

14. The World Food Prize is an international award recognizing the achievements of individuals who have advanced human development by improving the quality, quantity or availability of food in the world.

- I. The prize was created by Norman Borlaug
 - II. The first prize was given to M. S. Swaminathan
1. Only I is correct
 2. Only II is correct
 3. Both I and II are correct
 4. Both I and II are incorrect

15. Identify the correct statement:

- I. PAR designates the spectral range of solar radiation from 400 to 700 nanometers
 - II. PAR is less than 50% of the incident solar radiation
 - III. Plants capture only 2 to 10% of PAR
1. Only I and II
 2. Only I and III
 3. Only II and III
 4. I, II and III

16. In primary hydrarch succession, the seral stage just before the climax forest is likely to be:

1. Submerged free floating plant stage
2. Scrub stage
3. Marsh meadow stage
4. Reed swamp stage

17. Golden rice has been produced by:

1. Cross hybridisation with wild varieties
2. Transforming rice by genetic engineering
3. Mutation breeding
4. Somatic hybridisation

18. Arrange the steps of somatic hybridization in correct chronological order:

I. Protoplast fusion using electric shock (electrofusion) or chemical treatment.

II. The removal of the cell wall of one cell of each type of plant using cellulase enzyme to produce a somatic cell called a protoplast

III. The formation of the cell wall induced using hormones

IV. The cells are then grown into calluses which then are further grown to plantlets and finally to a full plant, known as a somatic hybrid.

1. I → II → III → IV
2. I → II → IV → III
3. II → I → III → IV
4. II → I → IV → III

19. Consider the given two statements:

I. Mutation breeding uses the spontaneous mutations.

II. Spontaneous mutations occur at a very high rate in the gene pool of an organism.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. Both I and II are incorrect

20. Biological nitrogen fixation directly results in the formation of:

1. Ammonium ions
2. Nitrate ions
3. Nitrite ions
4. Ammonia

21. Algal blooms:

I. are the result of a nutrient, like nitrogen or phosphorus from various sources entering the aquatic system and causing excessive growth of algae.

II. lead to increased dissolved oxygen in water body as algae are photosynthetic

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

22. Identify the correct statements:

I. Kalyan sona and Sonalika are semi-dwarf varieties of wheat.

II. Jaya and Ratna are varieties of rice developed in India.

III. Saccharum barberi had thicker stems and higher sugar content and did not grow well in North India

1. Only II
2. Only I and II
3. Only II and III
4. Only I and III

23. Somaclonal variation is the variation seen in plants that have been produced by:

1. Classical hybridization
2. Mutation breeding
3. Plant tissue culture
4. Genetic engineering

24. Identify the incorrect statement regarding primary productivity in an ecosystem?

1. It occurs only through the process of photosynthesis.
2. Almost all life on Earth relies directly or indirectly on primary production.
3. Net primary production is available for consumption by herbivores.
4. Gross primary productivity minus the respiratory loss is the net primary productivity.

25. Which of the following ecosystems are expected to have the least productivity?

1. Tundras
2. Tropical rain forests
3. Open oceans
4. Swamps and marshes

26. It is possible to obtain virus-free plants from virus-infected plants using the technique of:

1. Embryo rescue
2. Meristem culture
3. Biofortification
4. Phytoremediation

27. During the carbon cycle, carbon dioxide is returned to the atmosphere by the plants through:

1. Photosynthesis
2. Decomposition of biomass
3. Respiration
4. Transpiration

28. Mutation breeding has been used to create:

- I. Mung bean variety resistant to yellow mosaic virus
 - II. Abelmoschus variety resistant to yellow mosaic virus
1. Only I
 2. Only II
 3. Both I and II
 4. Neither I nor II

29. Match each item in Column I with one in Column II and select the correct match from the codes given:

Column I	Column II
A Eagle	P tertiary consumer
B Cyanobacterium	Q primary producer
C Fungus	R decomposer
D Grasshopper	S primary consumer

Codes:

- A B C D
- 1. P Q R S
- 2. Q P S R
- 3. R S Q P
- D. S R P Q

30. What would be true if you compare the flow of energy and the flow of chemical nutrients in an ecosystem?

1. Much larger amount of energy flows through the ecosystem than the amount of nutrients
2. Energy is recycled, but nutrients are not
3. The requirement of nutrients is obligatory for organisms but the requirement of energy is not.
4. Nutrients are recycled, but energy is not.

31. *Agrobacterium tumefaciens* infects the plant through its:

1. Chromosomal DNA
2. Complementary DNA
3. F plasmid
4. Ti plasmid

32. The number of species known and described of algae is more than that of all the following except:

1. Ferns
2. Lichens
3. Mosses
4. Fungi

33. *Cuscuta* [dodder]:

1. is capable of living in oligotrophic soils by getting nitrogen from insectivory
2. produces haustoria that insert themselves into the vascular system of the host
3. is a typical ephemeral that complete their life cycle over many years
4. is a succulent carrying out CAM photosynthesis

34. Identify the correct statements:

- I. Primary succession is faster than the secondary succession
 - II. Both hydrarch and xerarch successions lead to mesic conditions
 - III. Rooted submerged plants are pioneers in primary hydrarch succession
1. Only II
 2. Only III
 3. Only II and III
 4. Only I

35. An epiphyte is a plant that:

- I. grows on other plants for physical support
 - II. affects the host negatively
1. Only I is correct
 2. Only II is correct
 3. Both I and II are correct
 4. Both I and II are incorrect

Botany - Section B

36. Consider the given two statements:

- I. Spores and crystalline insecticidal proteins produced by *B. thuringiensis* are now used as insecticides in organic farming.
 - II. Because of their specificity, these pesticides are regarded as environmentally friendly, with little or no effect on humans, wildlife, pollinators, and most other beneficial insects.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. I is incorrect but II is correct

37. If plants convert about 1% of the sunlight they receive into chemical energy, the total energy originally present in the incident sunlight that is finally embodied in a tertiary consumer is about:

1. 0.1%
2. 0.01%
3. 0.001%
4. 0.0001%

38. The trophic level of an organism is the number of steps it is from the start of the food chain. The Level 2 typically will be occupied by:
1. Primary producer
 2. Herbivore
 3. Carnivore
 4. Apex predator
39. Identify the scientist, popularly known as Father of Wheat Revolution, and who was instrumental in developing 'PV 18' in 1966 and the most popular amber grained wheat variety 'Kalyansona' in 1967?
1. Gurdev Khush
 2. M. S. Swaminathan
 3. Dilbagh Singh Athwal
 4. Chidambaram Subramaniam
40. During organogenesis in plant tissue culture:
1. an excess of auxin will often result in a proliferation of roots, while an excess of cytokinin yield shoots
 2. an excess of auxin will often result in a proliferation of roots, while an excess of gibberellins yield shoots
 3. an excess of cytokinin will often result in a proliferation of roots, while an excess of gibberellins yield shoots
 4. an excess of gibberellins will often result in a proliferation of roots, while an excess of ethylene yield shoots
41. India has promised to become carbon neutral and achieve net zero emissions by
1. 2030
 2. 2050
 3. 2060
 4. 2070
42. For their work in the discovery and characterization of restriction enzymes, the 1978 Nobel Prize for Physiology or Medicine was awarded to:
1. Salvador Luria, Jean Weigle and Giuseppe Bertani
 2. Nirenberg, Matthaei and Korana
 3. Paul Berg, Stanley Cohen and Herbert Boyer
 4. Werner Arber, Daniel Nathans, and Hamilton O. Smith
43. Consider the given two statements:
- I. Xerophytic plants tend to have less overall surface area than other plants.
II. Less area that is exposed to the air reduces water loss by transpiration and evaporation.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect.
 4. Both I and II are incorrect.
44. In 1995, the European Patent Office wrongly granted a patent on an anti-fungal product derived from *Azadirachta indica* to the US Department of Agriculture and W. R. Grace and Company. The common name of this plant in India is:
1. Haldi
 2. Neem
 3. Basmati
 4. Arjun
45. Flavr Savr, a GM tomato, has been developed for:
1. Insect resistance
 2. Increased shelf life
 3. Herbicide resistance
 4. Increased vitamin A content
46. Plant tissue culture may offer certain advantages over traditional methods of propagation, including all the following except:
1. The production of plants that exhibit large variations from the parent plants.
 2. Quickly production of mature plants.
 3. The regeneration of whole plants from plant cells that have been genetically modified.
 4. Storage of genetic plant material to safeguard native plant species.
47. The biggest advantage of growing Bt cotton instead of non-Bt varieties is:
1. reductions in pesticides to be sprayed on a crop and the ecological benefits which stem from that.
 2. increased yield of cotton due to effective control of three types of bollworms
 3. Reduction in predators which help in controlling the bollworms by feeding on larvae and eggs of bollworm
 4. Potential reduction in the cost of cultivation

48. According to the 'India State of Forest Report (ISFR)' 2021, which state has the largest area-wise forest cover in the country?

1. Arunachal Pradesh
2. Chhattisgarh
3. Madhya Pradesh
4. Maharashtra

49. Quality protein maize (QPM) is a family of maize varieties. QPM grain contains nearly twice as much amino acids that are limiting amino acids in grains. These amino acids are:

1. Lysine and tryptophan
2. Methionine and cysteine
3. Glutamic acid and aspartic acid
4. Threonine and tyrosine

50. The most commonly used biological pesticide worldwide is:

1. *Agrobacterium tumefaciens*
2. *Pseudomonas putida*
3. *Bacillus thuringiensis*
4. *Trichoderma harzianum*

53. Why is a nucleic acid probe required in many genetic engineering experiments?

1. To clone genes
2. To produce a large amount of DNA from a tiny amount of DNA
3. To make DNA on the template of RNA
4. To identify genes that have been separated by electrophoresis, or mRNA molecules through in-situ hybridization

54. The population of Ukraine today is most likely to be affected by:

1. Natality
2. Mortality
3. Immigration
4. Emigration

55. Three Mile Island and Chernobyl are located respectively in:

1. USA and Russia
2. Russia and Canada
3. USA and Ukraine
4. England and Uzbekistan

Zoology - Section A

51. Beginning with a single template DNA, a PCR reaction is allowed to continue for 30 cycles. The number of copies of the template DNA at the end is expected to be about:

1. 256
2. 256,000
3. 1 million
4. 1 billion

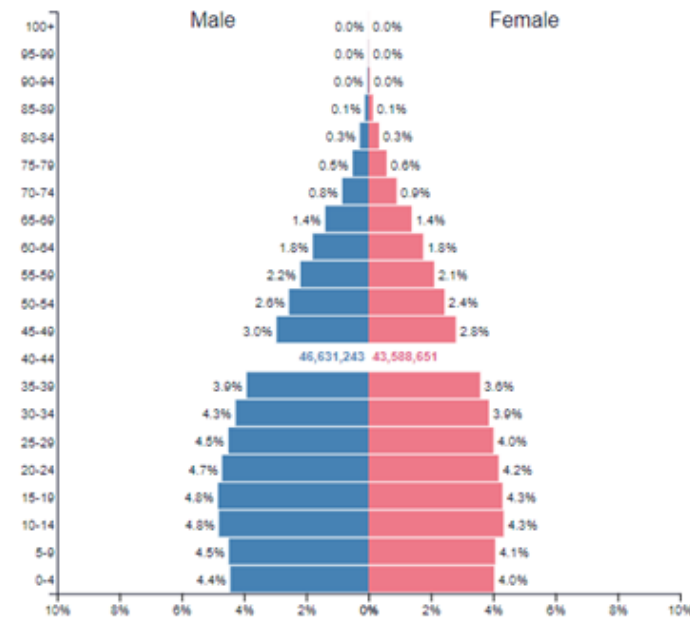
52. Identify the correct statements:

- I. Chipko movement aimed at protecting trees and forests.
 - II. Joint Forest Management originated in West Bengal in 1980's in India.
 - III. The Amrita Devi Bishnoi Wildlife Protection Award is a national award instituted by the government of India for wildlife conservation.
1. Only I and II
 2. Only I and III
 3. Only II and III
 4. I, II and III

56. Consider the two statements:

- I. Inbreeding is necessary if we want to evolve a pureline in any animal.
 - II. Continued inbreeding often results in reduced fertility and productivity.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. Both I and II are incorrect

57. Given below are two population pyramids, both of India, one for year 2000 and another for year 2020:



1. Pyramid A is of 2020 as it has a broader base
2. Pyramid B is of 2000 as it has more females in the younger age groups
3. Pyramid B is of 2020 as it has more females in the younger age groups
4. Pyramid A is of 2000 as it has a broader base

58. Which of the following tools of recombinant DNA technology is incorrectly paired with its use?

1.	DNA ligase	cutting DNA, creating sticky ends of restriction fragments
2.	DNA polymerase	polymerase chain reaction to amplify sections of DNA
3.	Electrophoresis	separation of DNA fragments
4.	Reverse transcriptase	production of cDNA from mRNA

59. Predators:

1. act as conduits for energy transfer across trophic levels
2. do not include herbivores in broad ecological context
3. indiscriminately kill their prey
4. have a very high biotic potential

60. Consider the given statements:

- I. Eutrophication is the natural aging of a lake by nutrient enrichment of its water.
 - II. Cultural Eutrophication is in effort by the Ministry of Culture to save lakes and ponds from eutrophication.
1. Only I is correct
 2. Only II is correct
 3. Both I and II are correct
 4. Both I and II are incorrect

61. The controlled cultivation of aquatic organisms such as fish, crustaceans, mollusks, algae and other organisms of value such as aquatic plants is known as:

1. Fisheries
2. Aquaculture
3. Pisciculture
4. Commercial fishing

62. Amongst the following which gas is the least contributor to total global warming?

1. Methane
2. Carbon dioxide
3. Chlorofluorocarbons
4. Nitrous oxide

63. Identify the incorrectly matched pair:

1.	Connell	Competitive release
2.	Gauss	Competitive exclusion principle
3.	MacArthur	Resource partitioning
4.	Tillman	Rivet popper hypothesis

64. Identify the incorrect statement:

1. Mercury and DDT undergo biomagnifications in the terrestrial food chain.
2. Nitrates and phosphates can cause rapid enrichment of nutrients in a lake.
3. Recycling is the only solution for the treatment of E-waste.
4. Without greenhouse effect the average temperature at surface of earth would have been minus 18⁰C

65. Kangaroo rat:

- I. has a marsupium to nurse the young ones
 - II. obtain enough water from the metabolic oxidation of the seeds they eat to survive and do not need to drink water at all
1. Only I is correct
 2. Only II is correct
 3. Both I and II are correct
 4. Both I and II are incorrect

66. PCR does not require:

1. A thermostable DNA polymerase
2. Dideoxy-dNTPs (ddNTPs)
3. Template DNA
4. Primers

67. Consider the given statements:

- I. Temperature is the most important ecologically relevant environmental factor.
 - II. Animals living in aquatic environment do not face any water related problems.
 - III. Photoperiod has no effect on animal reproduction.
1. Only II and III are correct
 2. Only I is correct
 3. Only I and III are correct
 4. Only III is correct

68. Identify the incorrect statement:

1. Thylacine is an extinct carnivorous marsupial that was native to the Australian mainland.
2. The mass extinction currently in progress is the fifth mass extinction.
3. Habitat loss and fragmentation is the most important cause driving animals and plants to extinction.
4. The Nile perch introduced into Lake Victoria became invasive.

69. The predominant honeybee found and most commonly domesticated in India is:

1. *Apis cerana indica*
2. *Apis mellifera*
3. *Apis dorsata*
4. *Apis florea*

70. The first licensed drug generated using recombinant DNA technology was:

1. Human growth hormone
2. Human insulin
3. Tissue plasminogen activator
4. Factor VIII

71. The source of the reverse transcriptase used in recombinant DNA technology, is a:

1. retrovirus
2. plant cell
3. cultured fungal cell
4. cultured phage-infected mammalian cell

72. Match each item in column I with one in column II and select the correct match from the codes given:

	Column I		Column II
A	Hibernation	P	Bears in winter months
B	Aestivation	Q	Air breathing land snails
C	Diapause	R	Zooplankton in lakes and ponds

Codes:

	A	B	C
1.	P	Q	R
2.	Q	P	R
3.	P	R	Q
4.	R	Q	P

73. The First Tiger Reserve of India is in:

1. Kerala
2. Madhya Pradesh
3. Assam
4. Uttarakhand

74. What is incorrect regarding Multiple Ovulation Embryo Transfer technology used in cattle breeding?

1. Hormone with FSH like activity is used to induce super ovulation
2. The cow is mated with an elite bull or artificially inseminated
3. Fertilized eggs are recovered surgically at 4-8 cell stage
4. The proembryos are transferred to surrogate mothers

75. Influenza A virus subtype H5N1 causes:

1. Swine flu
2. Dengue
3. Covid-19
4. Avian influenza

76. Out-crossing:

I. is the best breeding method for animals that are below average in productivity in milk production, growth rate and beef cattle.

II. helps to overcome inbreeding depression

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

77. Arrange the following acts in their chronological sequence in which they were passed in India [earliest to latest]:

- I. Air [Prevention and Control of Pollution] Act
- II. Environment [Protection] Act
- III. Water [Prevention and Control of Pollution] Act

1. II, III, I
2. III, I, II
3. II, I, III
4. I, II, III

78. Ahmed Khan of Bangalore is famous for his:

1. concept of organic farming
2. contribution for developing ways of disposing radioactive wastes
3. discovery of the process of incineration
4. innovation that can be a remedy for plastic wastes

79. El Nino:

1. is a climate pattern that describes the unusual warming of surface waters in the eastern Pacific Ocean.
2. is a climate pattern that describes the unusual cooling of surface waters in the eastern Pacific Ocean.
3. is a climate pattern that describes the unusual heavy monsoon rains in the Indian subcontinent in winters.
4. is a climate pattern that describes the unusual warming of the Arctic causing large scale meltdown of ice.

80. If the core body temperature of a human body goes below 37°C, the feedback mechanism elicited to bring the temperature back to normal will include:

1. Vasoconstriction and sweating
2. Vasodilation and sweating
3. Vasoconstriction and shivering
4. Vasodilation and shivering

81. VNTRs are a type of:

1. Microsatellites
2. Ministaellites
3. SNPs
4. Secondary constrictions

82. The mean annual precipitation is most variable in:

1. Tropical forest
2. Desert
3. Grassland
4. Arctic tundra

83. Very small animals are rarely found in polar regions mainly because:

1. there is abundance of large predators in the polar regions
2. very small animals are generally herbivores and grasses do not grow in polar regions
3. the water is found only beneath the frozen ice in polar regions
4. they have a larger surface area relative to their volume

84. Montreal protocol:

1. is an international treaty designed to protect the ozone layer signed in 1987, and entered into force in 1989.
2. is an international treaty designed to control global warming signed in 1991, and entered into force in 1993.
3. is an international treaty designed to protect the ecological hotspots of biodiversity signed in 1987, and entered into force in 1989.
4. is an international treaty designed to protect wetlands signed in 1985, and entered into force in 1987.

85. The dideoxynucleotide chain-termination method:
1. is used to produce recombinant proteins in a heterologous host
 2. was developed by Fred Sanger and used in human genome sequencing
 3. is an improved version of PCR for DNA multiplication
 4. is used to ensure gene expression in a heterologous host

Zoology - Section B

86. Consider the two statements:
- I. Haemoglobin in humans adapted to very high altitudes has a lower binding affinity for oxygen than that found in humans living at the sea level.
 - II. Lower affinity of haemoglobin to oxygen means more oxygen can bind to haemoglobin even at low partial pressures
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. Both I and II are incorrect

87. Consider the given two statements:
- I. It is beneficial to have a multiple cloning site (MCS) within the lac Z gene.
 - II. When foreign DNA interrupts the lac Z gene, no β-galactosidase can be formed, and X-Gal remains colourless which allows the researcher to distinguish between recombinant and unrecombinant vectors.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. Both I and II are incorrect

88. Consider the two statements:
- I. Mules are mostly infertile.
 - II. Mule is the hybrid of a male donkey and a female horse.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. Both I and II are incorrect

89. Semelparity is a reproductive strategy also known as "big bang" reproduction. This is because the single reproductive event of semelparous organisms is usually large as well as fatal. A classical example is seen in:
1. Most perennial plants
 2. Mollusks
 3. Pacific salmon
 4. Humans

90. Bacterial cells synthesize restriction endonucleases because restriction endonucleases help the bacterial cells:
1. grow readily in medium containing antibodies.
 2. protect themselves from viral infection.
 3. open up the DNA in their chromosomes so that transcription is easier.
 4. take up foreign DNA from their environment and combine it into their genome.

91. Consider the two statements:
- I. Agar Gel electrophoresis is useful in analysis of DNA.
 - II. DNA is generally positively charged due to its nitrogenous bases so an electrical field forces it to move toward a negative pole.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. Both I and II are incorrect

92. A form of mimicry where a harmless species has evolved to imitate the warning signals of a harmful species directed at a predator of them both is called as:
1. Mullerian mimicry
 2. Batesian mimicry
 3. Aposematism
 4. Camouflage

93. Consider the following two statements:
- I. Plasmid can be used as a vector in recombinant DNA technology experiments.
 - II. Plasmid is an extrachromosomal, circular, double stranded DNA found in some bacteria.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is correct but II is incorrect
 4. Both I and II are incorrect

94. The relationship between *Nitrosomonas* and *Nitrobacter* can be best described as:

1. Mutualism
2. Commensalism
3. Competition
4. Amensalism

95. Consider the two given statements:

I. The life cycles of endoparasites are more complex than that of the ectoparasites.

II. The morphological and anatomical features of endoparasites are greatly simplified.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. Both I and II are incorrect

96. Consider the two statements:

I. Transcripts of eukaryotic genes cannot be translated by bacteria.

II. Eukaryotic genes contain introns.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. Both I and II are incorrect

97. Consider the two statements:

I. Diseases such as sickle cell disease that are caused by autosomal recessive disorders may be a good candidate for gene therapy treatment.

II. For such disorders, a person's normal phenotype or cell function may be restored in cells that have the disease by a normal copy of the gene that is mutated.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. Both I and II are incorrect

98. Fishes living in freshwater:

1. drink lot of water, pass lot of urine and constantly lose salt to the outside
2. do not drink water, pass lot of urine and constantly pick salt actively from the outside
3. do not drink water, pass highly concentrated urine and constantly pick salt actively from the outside
4. drink water, pass highly concentrated urine and constantly lose salt actively to the outside

99. Bakhira Wildlife Sanctuary, a new Ramsar site is located in:

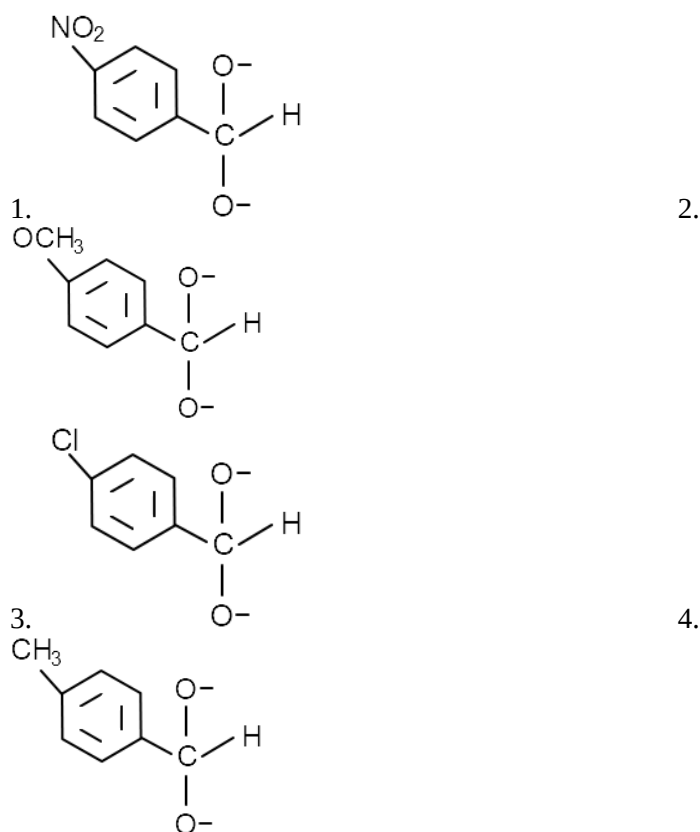
1. Uttar Pradesh
2. Gujarat
3. Madhya Pradesh
4. Rajasthan

100. Which of the following would be a correct representation of median age in Indian population?

1. 10 years
2. 28 years
3. 55 years
4. 72 years

Chemistry - Section A

101. Compound, among the following that can donate hydride fastest is -



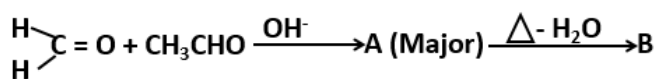
102. Pyrolygneous acid does not contain

1. Acetic acid
2. Ethanol
3. Methanol
4. Acetone

103. The Hell Volhard Zelinsky (HVZ) reaction is not given by

1. Acetic acid
2. 2,2-dimethyl propanoic acid
3. 2-Methyl propanoic acid
4. 2,3-dimethyl butanoic acid

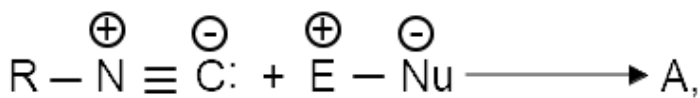
104.



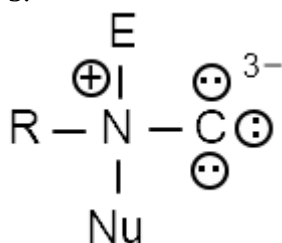
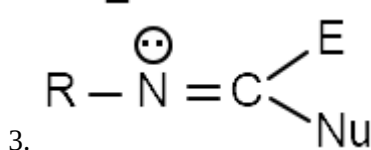
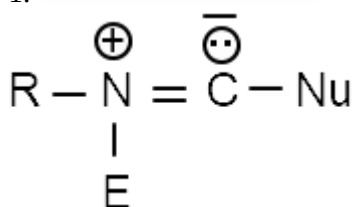
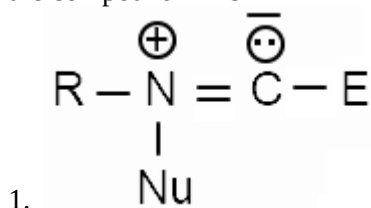
The compound 'B' is

1. Crotonaldehyde
2. Acrolein
3. Mesityl oxide
4. Propanal

105.



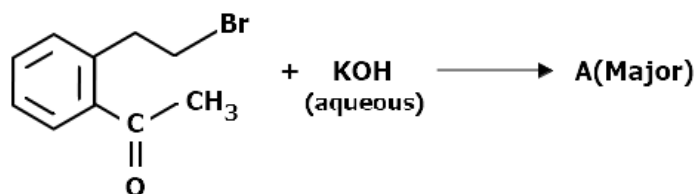
the compound 'A' is



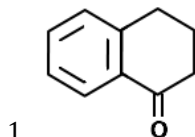
106. The least basic compound amongst the following is:

1. Pyrrole
2. Pyridine
3. Aniline
4. Benzyl amine

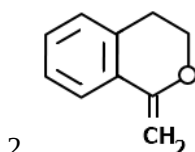
107.



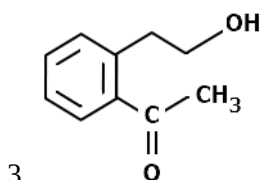
A is



1.



2.

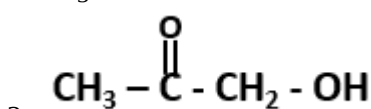


3.

4. Both (1) and (2)

108. The compound which would respond to Tollen's reagent is

1. CH_3CHO

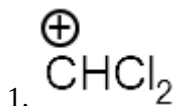


2.

3. HCOOH

4. All of these

109. In the Carbylamine reaction, the intermediate formed is



1.

2.

3.

4.

1.

2.

3.

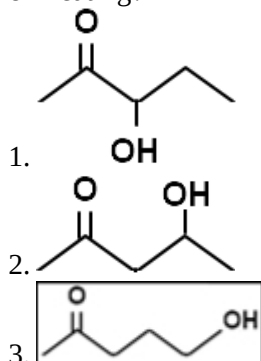
4.

110. Case study

Aldol Condensation

When two carbonyl compounds having α -hydrogen atoms are condensed in presence of dilute alkali to form a compound that has the properties of alcohol as well as carbonyl compound, the compound is known as ALDOL. Aldol is unstable and on heating, it eliminates one H_2O molecule and is converted into α, β -unsaturated aldehyde or ketone


Which of the following compounds is readily dehydrated on heating?




4. All are equally dehydrated

111. When phenol is reacted with CCl_4 and $NaOH$, salicylic acid is formed. In this reaction, the intermediate formed is-

1. $:CCl_2$

2. 

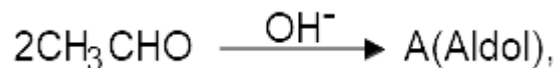
3. 

4. No intermediate is formed

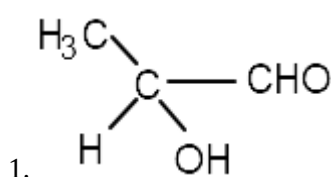
112. Case study

Aldol Condensation

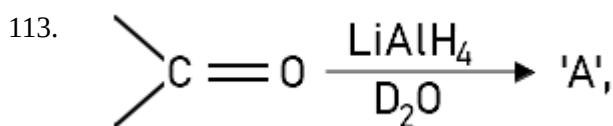
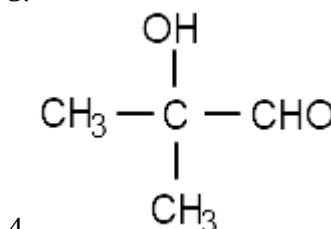
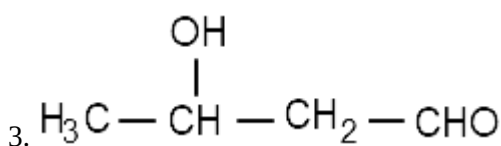
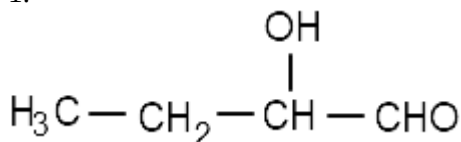
When two carbonyl compounds having α -hydrogen atoms are condensed in presence of dilute alkali to form a compound that has the properties of alcohol as well as carbonyl compound, the compound is known as ALDOL. Aldol is unstable and on heating, it eliminates one H_2O molecule and is converted into α, β -unsaturated aldehyde or ketone



Compound 'A' is

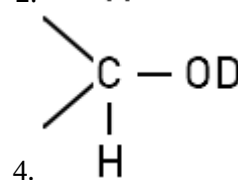
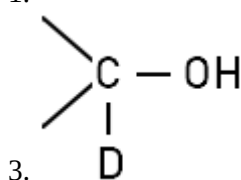
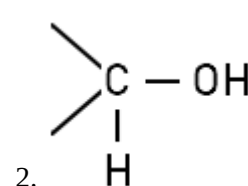
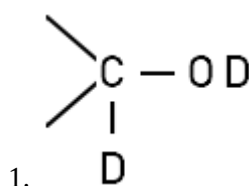


2.



the

compound 'A' is



114. In Cannizarro's reaction, we use 50% NaOH or KOH instead of dilute NaOH or KOH. The reason for using the 50% NaOH or KOH in Cannizarro's reaction is

1. To convert monoanion to dianion
2. To prevent the abstraction of hydrogen atom which is attached with carbonyl carbon
3. To enhance the release of H^+ ion
4. None of the above

115. The reason behind formation of isocyanide in the reaction between alkyl halide and AgCN, is-

1. AgCN is an electrovalent compound
2. AgCN is a covalent compound
3. In -CN, lone pair of e^- s is present on carbon only
4. None of the above

116. When alcohol is reacted with $SOCl_2$ in presence of pyridine then alkyl chloride is formed. The reaction follows the mechanism

1. S_N1
2. S_N2
3. S_Ni
4. $S_Ni + S_N2$

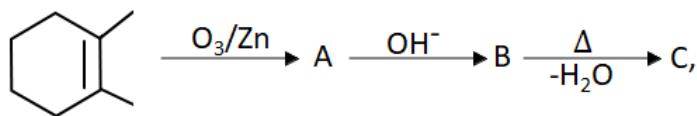
117. Victor Meyer's test is used to distinguish

1. 1° , 2° , and 3° alcohols
2. 1° , 2° , and 3° Alkyl halides
3. 1° , 2° , and 3° Nitro compounds
4. All of the above

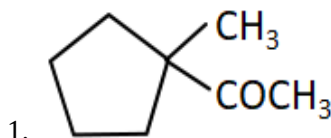
118. When a mixture of calcium formate and calcium acetate is dry distilled, possible carbonyl compound formed is

1. Formaldehyde
2. Acetaldehyde
3. Acetone
4. All of these

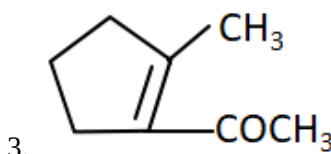
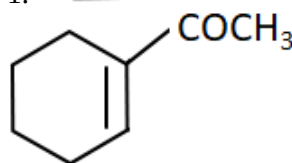
119.



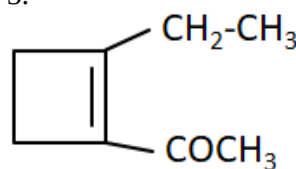
The compound 'C' is



2.



4.



120. When ethyl formate is reacted with excess of C_2H_5MgBr followed by hydrolysis, the final product formed is

1. Pentan-2-ol
2. 2-Methyl butan-2-ol
3. Pentan-3-ol
4. 2-Methyl butan-1-ol

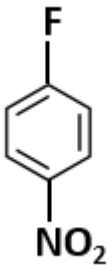
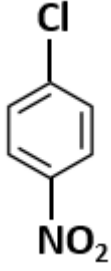
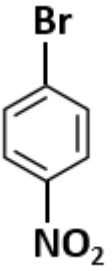
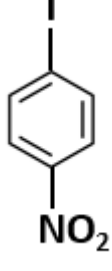
121. Nascent chlorine, in the reaction of bleaching powder with ethanol, acts as -

1. Oxidising agent
2. Chlorinating agent
3. Both (1) and (2)
4. Reducing agent

122. The correct order of reactivity, amongst the given arrangements, towards nucleophilic addition, is

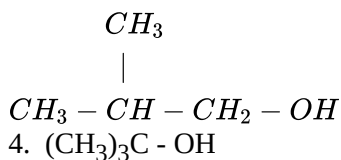
1. $HCHO > CH_3CHO > CH_3COCH_3 > C_6H_5CHO$
2. $C_6H_5CHO > HCHO > CH_3CHO > CH_3COCH_3$
3. $HCHO > CH_3CHO > C_6H_5CHO > CH_3COCH_3$
4. $HCHO > C_6H_5CHO > CH_3CHO > CH_3COCH_3$

123. The most reactive haloarene towards aromatic nucleophilic substitution is

1. 
2. 
3. 
4. 

124. Which alcohol is most reactive in esterification reaction?

1. CH_3OH
2. $\text{CH}_3\text{CH}_2\text{OH}$
- 3.

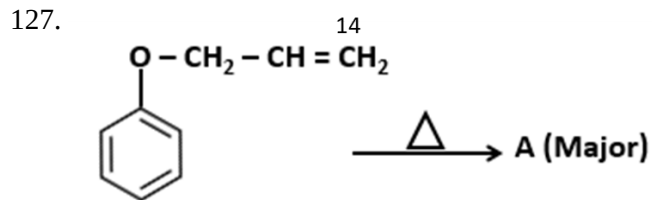


125. Sorbitol ($\text{HOH}_2\text{C}(\text{CHOH})_4\text{CH}_2\text{OH}$) has 4 asymmetric carbon atoms. The number of optically active and optically inactive isomers, respectively, are

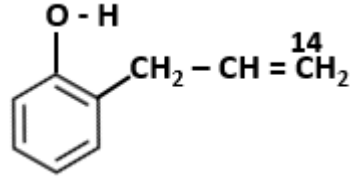
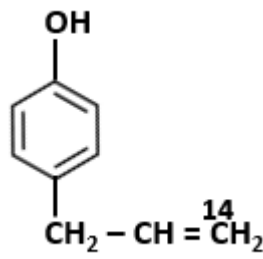
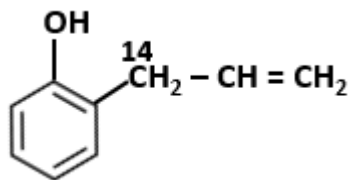
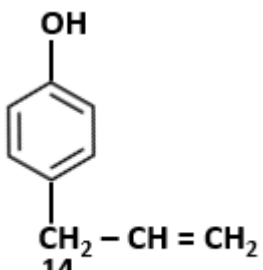
1. 12 & 4
2. 16 & 0
3. 10 & 2
4. 8 & 2

126. The correct order of the acidity of nitrophenols is

1. o-> m-> p-
2. o-> p->m-
3. p-> m-> o-
4. p->o->m-

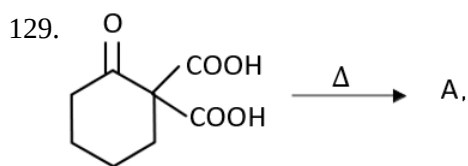


The compound 'A' is

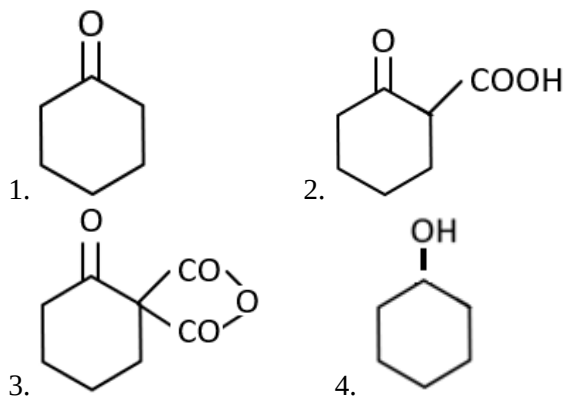
1. 
2. 
3. 
4. 

128. In the first step, in esterification reaction, H^+ attacks on

1. Oxygen atom of an alcohol
2. Doubly bonded oxygen of carboxylic acid
3. Singly bonded oxygen of carboxylic acid
4. Any oxygen atom



is



130. The most acidic compound is

1. CHF₃
2. CHCl₃
3. CHBr₃
4. CHI₃

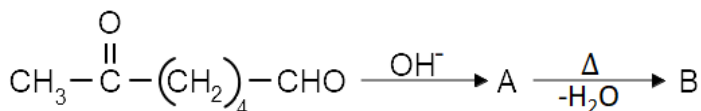
131. When Grignard reagent reacts with HCN or RCN followed by hydrolysis, carbonyl compound is formed. The carbonyl compound which cannot be formed in the above reaction is -

1. HCHO
2. CH₃CHO
3. CH₃COCH₃
4. All carbonyl compound can formed

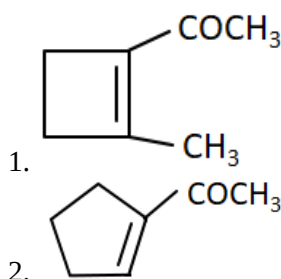
132. Case study

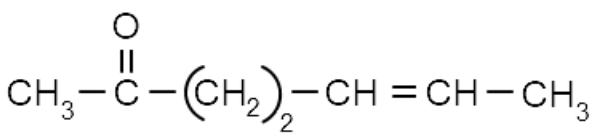
Aldol Condensation

When two carbonyl compounds having α -hydrogen atoms are condensed in presence of dilute alkali to form a compound that has the properties of alcohol as well as carbonyl compound, the compound is known as ALDOL. Aldol is unstable and on heating, it eliminates one H₂O molecule and is converted into α,β -unsaturated aldehyde or ketone



Compound 'B' is



3. 
4. None of the above

133. When glycerol is reacted with an excess of HI, the final product formed is

1. Allyl iodide
2. 2-iodopropane
3. Propene
4. 1,2,3 - tri-iodopropane

134. A carbonyl compound reacts with HCN followed by hydrolysis to give lactic acid. The carbonyl compound is

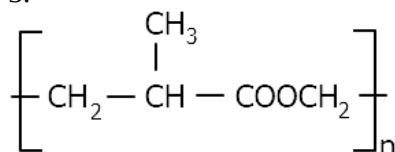
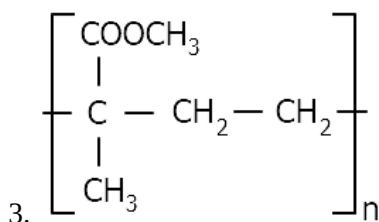
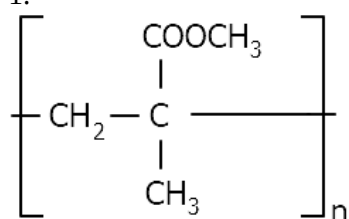
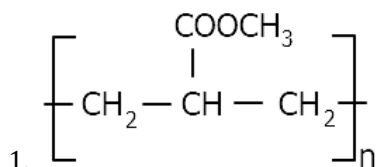
1. HCHO
2. CH₃CHO
3. CH₃COCH₃
4. CH₃CH₂CHO

135. When phenol is reacted with concentrated HNO₃ and concentrated H₂SO₄, 2,4,6-trinitrophenol is formed. The correct statement from the following with respect to this reaction is

1. Firstly we added concentrated H₂SO₄ and then we added concentrated HNO₃
2. Firstly we added concentrated HNO₃ and then we added concentrated H₂SO₄
3. Both concentrated HNO₃ and concentrated H₂SO₄ are added together
4. Here, concentrated H₂SO₄ acts as dehydrating agent

Chemistry - Section B

136. The correct representation of PMMA (Polymethylmethacrylate) is -



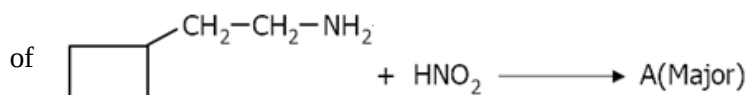
137. Which polymer is formed by cationic as well as anionic polymerisation?

1. Teflon
2. Polystyrene
3. Poly Vinyl chloride (PVC)
4. Orlon

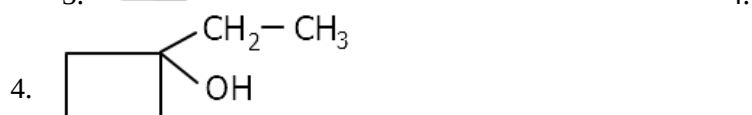
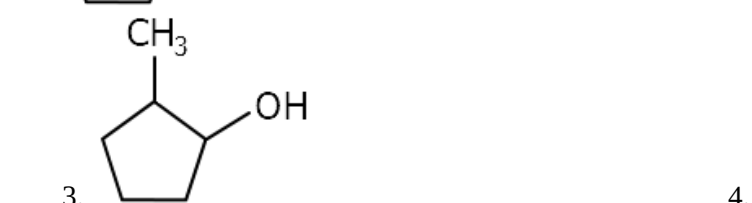
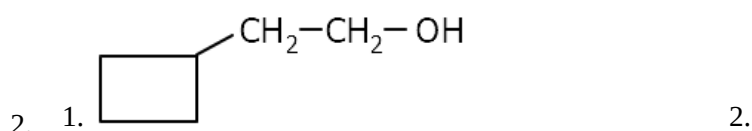
138. Which solution acts as an antiseptic and not as a disinfectant?

1. 0.2 to 0.4 ppm chlorine in aqueous solution
2. 2-3% I₂ solution in alcohol and water
3. 1% solution of phenol
4. Sulphur dioxide in very low concentration

139.



Compound 'A' is



140. The narrow-spectrum antibiotic amongst the following is

1. Chloramphenicol
2. Penicillin G
3. Vancomycin
4. Ofloxacin

141. Lactose is a disaccharide. It is composed of

1. α - D-Glucose and β - D-Galactose
2. β - D-Glucose and β - D-Galactose
3. β - D-Glucose and α - D-Galactose
4. α - D-Glucose and α - D-Galactose

142. Oil of wintergreen is obtained by the reaction of

1. Salicylic acid and CH₃COCl
2. Salicylic acid and CH₃OH
3. Salicylic acid and C₆H₅OH
4. Phenol and C₆H₅COCl

143. Which reagent is used to distinguish glucose and fructose?

1. Fehling's solution
2. Tollen's reagent
3. Br₂ water
4. All of the above

144. When $\beta - D$ -Glucose is dissolved in water then its specific rotation

1. Increases
2. Decreases
3. Remains unchanged
4. First increases and then decreases

145. The monomer unit of Nylon-6 is caprolactam. Caprolactam is formed from the reaction of

1. Cyclohexanone and Hydroxylamine
2. Cyclohexanone and Hydrazine
3. Cyclopentanone and Hydroxylamine
4. Cyclopentanone and Hydrazine

146. The C-2 and C-4 anomer of $\alpha - D$ -Glucose, respectively are

1. Lactose and Mannose
2. Galactose and Fructose
3. Mannose and Galactose
4. Galactose and Mannose

147. How many phenyl hydrazine molecules are used for the conversion of one molecule of glucose into glucosazone?

1. 1
2. 2
3. 3
4. 4

148. Which artificial sweetener has the highest sweetness value in comparison to cane sugar?

1. Aspartame
2. Saccharin
3. Sucralose
4. Alitame

149. The correct order of the strength of intermolecular forces of attraction is

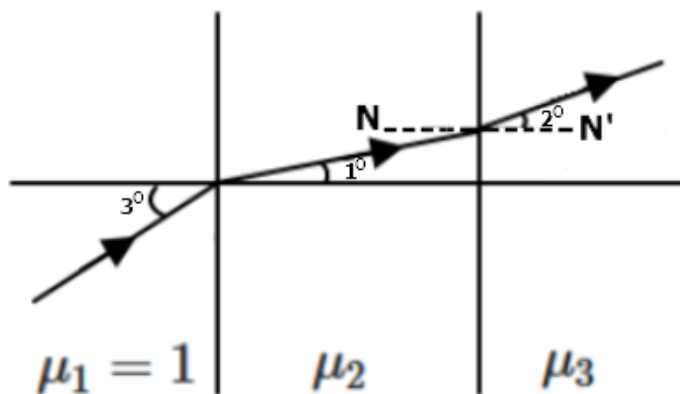
1. Thermoplastic > Fibres > Elastomers
2. Elastomers > Fibres > Thermoplastic
3. Fibres > Thermoplastic > Elastomers
4. Fibres > Elastomers > Thermoplastics

150. Coupling reaction is an example of

1. Nucleophilic substitution reaction
2. Electrophilic substitution reaction
3. Elimination reaction
4. Free radical substitution reaction

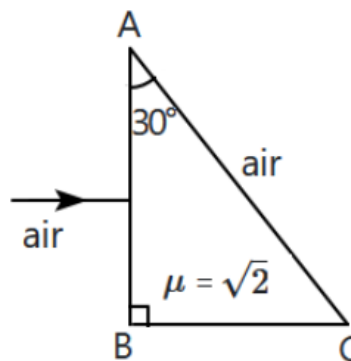
Physics - Section A

151. A ray of light passes through three parallel media, with the angles of incidence and emergence as shown in the figure. The refractive indices of the media are $\mu_1 = 1$, μ_2 and μ_3 . Then:



1. $\mu_2 = \frac{1}{3}$, $\mu_3 = \frac{1}{2}$
2. $\mu_2 = 3$, $\mu_3 = \frac{3}{2}$
3. $\mu_2 = \frac{1}{3}$, $\mu_3 = \frac{2}{3}$
4. $\mu_2 = 3$, $\mu_3 = 2$

152. A ray of light is incident normally onto the surface AB of a right-angled prism ABC ($\angle B = 90^\circ$) and emerges from the surface AC. The refractive index of the material of the prism is $\mu = \sqrt{2}$.



The ray undergoes a deviation of

1. 15°
2. 30°
3. 45°
4. 60°

153. The frequency of light in a photoelectric experiment is tripled. The stopping potential will

1. be tripled.
2. be more than tripled.
3. be less than tripled.
4. become one third.

154. In Young's double-slit experiment conducted with light of an unknown wavelength, it is found that the fringe width is twice the separation between the slits, d , which is 0.5 mm. The slit to screen distance is 1 m. The wavelength of light used is:

1. 125 nm
2. 250 nm
3. 500 nm
4. 1000 nm

155. The sun has a diameter of 1.4×10^6 km and is at a distance of 150×10^6 km from the earth. An image of the sun is formed by a convex lens of focal length 30 cm. The diameter of the image is:

1. 2.8 cm
2. 2.8 mm
3. 1.4 mm
4. 0.7 mm

156. The shortest wavelength of X-rays produced by a Coolidge tube is 50 pm. The voltage applied to the tube is nearly:

(Take $hc = 1240$ eV-nm)

1. 12.4 kV
2. 25 kV
3. 50 kV
4. 20 kV

157. A hydrogen atom in the ground state absorbs an ultraviolet photon of wavelength 25 nm. Ignore any momentum associated with the photon. The ejected electron has an energy of nearly:

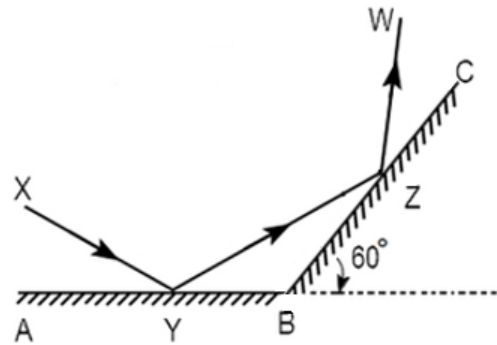
(Take $hc = 1240$ eV-nm)

1. 10 eV
2. 25 eV
3. 35 eV
4. 50 eV

158. A hydrogen atom collides with another similar atom at rest. The minimum energy of the first atom so that one of them may get ionised is:

1. 13.6 eV
2. $\frac{13.6}{2}$ eV
3. 2×13.6 eV
4. 10.2 eV

159. AB, BC are a pair of mirrors inclined so that the angle between their planes is 60° , as shown in the figure. A ray of light XY is incident on AB and emerges as the ray ZW after two reflections. If the incident ray is rotated so that $\angle AYX$ decreases by 15° , then $\angle WZC$



1. increases by 15° .
2. increases by 30° .
3. decreases by 15° .
4. decreases by 30° .

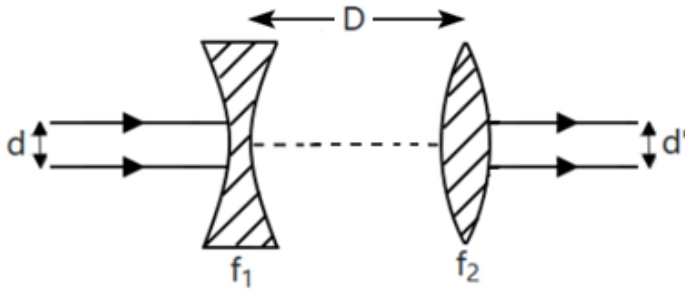
160. A double-slit experiment is performed with one slit four times as wide as the other. The ratio of the maximum and minimum intensities on the screen, $\frac{I_{max}}{I_{min}} =$

1. $\frac{5}{3}$
2. $\frac{3}{1}$
3. $\frac{25}{9}$
4. $\frac{9}{1}$

161. A beam of light of power P is normally incident on a flat surface which reflects 50% and absorbs the rest. The force exerted by the beam on the surface is (c is the speed of light in vacuum):

1. zero
2. P/c
3. $0.5 P/c$
4. $1.5 P/c$

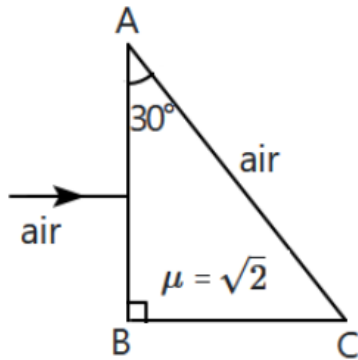
162. A diverging lens (focal length of magnitude f_1) and a converging lens (focal length f_2) are placed with a common principal axis. The separation between the lenses is D . A thin parallel beam of width d enters from the left and emerges as a parallel beam of width d' .



Then,

1. $D = f_1 + f_2$, and $d' = d$
2. $D = f_1 - f_2$, and $d' < d$
3. $D = f_2 - f_1$, and $d' > d$
4. $D = f_1 + f_2$, and $d' > d$

163. A ray of light is incident normally onto the surface AB of a right-angled prism ABC ($\angle B = 90^\circ$) and emerges from the surface AC . The refractive index of the material of the prism is $\mu = \sqrt{2}$.



At what other angle of incidence on the surface AB will the ray undergo the same total deviation as before?

1. 15°
2. 30°
3. 45°
4. 60°

164. The electric field associated with a light beam incident on a metallic surface with work-function 3.0 eV , is given by $E = E_o \sin(\pi \times 10^7 m^{-1})(x - ct)$.

The stopping potential for the emitted photoelectrons is: (Take $hc = 1240 \text{ eV-nm}$, if required)

1. 0.1 V
2. 3.2 V
3. 9.4 V
4. None of the above

165. A convex lens forms a real image of the same size as that of the object, but when it is moved closer by 15 cm it forms a real image that is twice as large. The focal length of the lens is:

1. 15 cm
2. 30 cm
3. 45 cm
4. 90 cm

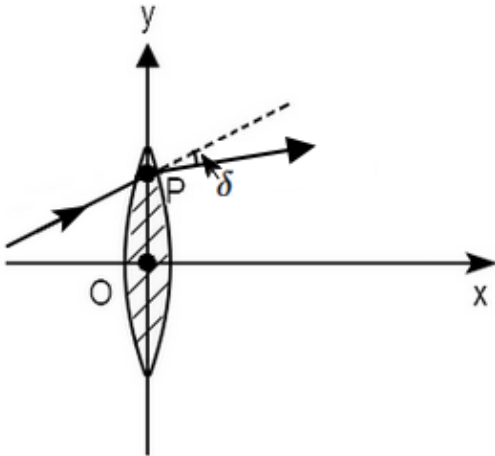
166. Find the minimum order of a green fringe ($\lambda = 500 \text{ nm}$) which overlaps a dark fringe of violet ($\lambda = 400 \text{ nm}$) in a Young's double-slit experiment conducted with these two colours.

1. 4
2. 2
3. 5
4. 2.5

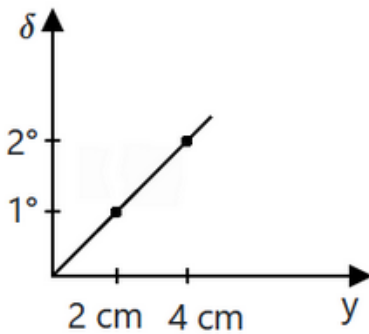
167. Let n_h, n_e be the number of holes and electrons in a sample of silicon (Si) doped with phosphorous (P). Then,

1. $n_h = n_e$
2. $n_h > n_e$
3. $n_e > n_h$
4. any of the above may be true depending on the temperature of the sample.

168.



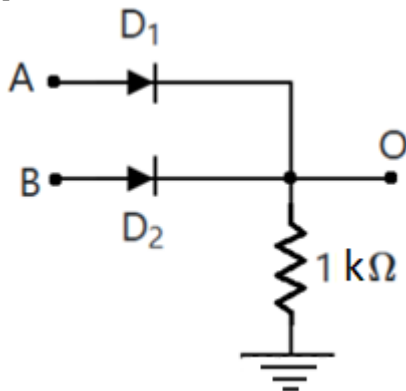
A lens is placed as shown in the figure, with the x-axis along the principal axis and the origin at the optical centre. A ray of light incident on the lens at P (0, y) undergoes a deviation δ . A graph of δ vs y is shown:



The focal length of the lens is nearly:

1. 2 cm
2. 20 cm
3. 115 cm
4. 230 cm

169. The inputs A and B can be set to +5 V (representing logic 1) or 0 V (representing logic 0). Then, the circuit in the figure below represents:



1. OR - Gate
2. AND - Gate
3. NOR - Gate
4. NAND - Gate

170. A thin equi-convex lens of refractive index 1.2 is dipped in oil of index 1.44. The lens has a power of 2 D (in air). When it is immersed in the oil, the focal length of the lens becomes:

1. 50 cm
2. -50 cm
3. -50/1.2 cm
4. -50x1.2 cm

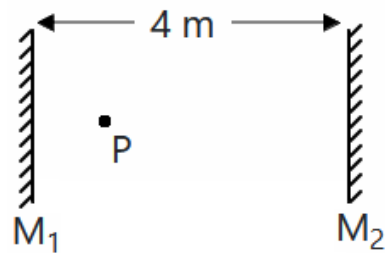
171. Photons of frequency ν fill a room. A metallic plate having a work function W ($< h\nu$) is moved with a velocity v , in this room. The maximum energy of the emitted photoelectrons (in the plate's frame)

1. does not depend on v
2. increases as v increases
3. decreases as v increases
4. first increases and then decreases as v is increased

172. The half-life of radioactive iodine, I^{131} is 8 days. A sample of iodine has an activity of $40 \mu Ci$. What will be its activity after 4 days?

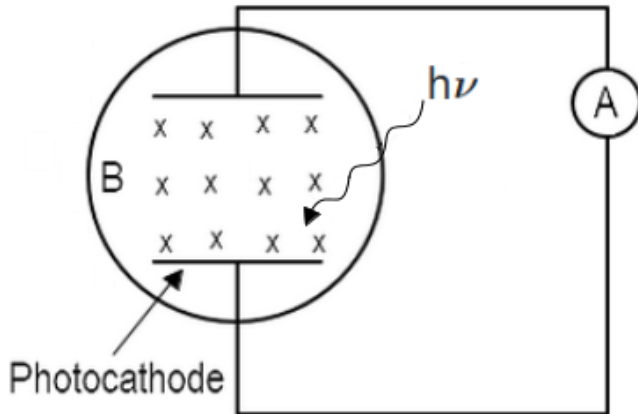
1. $20 \mu Ci$
2. $20\sqrt{2} \mu Ci$
3. $32 \mu Ci$
4. $10 \mu Ci$

173. Two parallel mirrors M_1, M_2 are placed facing each other on opposite sides of a room. The separation of the mirrors, as shown in the figure below, is 4 m. A point object P is placed at a distance of 1 m from M_1 . The separation between the images formed after a single reflection is:



1. 2 m
2. 6 m
3. 8 m
4. 4 m

174. Photons of energy $h\nu$ (ν = frequency) incident onto a photocathode cause the emission of photoelectrons, and a current flows in the circuit. Assume the photoelectrons are emitted normal to the photocathode. A uniform magnetic field B is switched on parallel to the plates (into the plane). The work function is W and the separation between the cathode and anode is 'd'. The minimum value of B for which the ammeter shows zero current satisfies:



1. $Bed = (h\nu - W)$.
2. $(Bed)^2 = m(h\nu + W)$.
3. $(Bed)^2 = 2m(h\nu - W)$.
4. $(Bed)^2 = 2m(h\nu + W)$.

175. A fraction f of the incident energy in a beam of light of wavelength λ is absorbed by a metallic surface and causes photoemission. If the power of the beam falling on the surface is P , then the maximum photocurrent is (e is electronic charge, h is Planck's Constant, c is the velocity of light in vacuum):

1. $\frac{\lambda P}{hc} f$
2. $\frac{2\lambda P}{hc} f$
3. $\frac{\lambda P}{hc} fe$
4. $\frac{2\lambda P}{hc} fe$

176. Atomic number increases in

1. α - decay.
2. β^- - decay.
3. β^+ - decay.
4. K - electron capture.

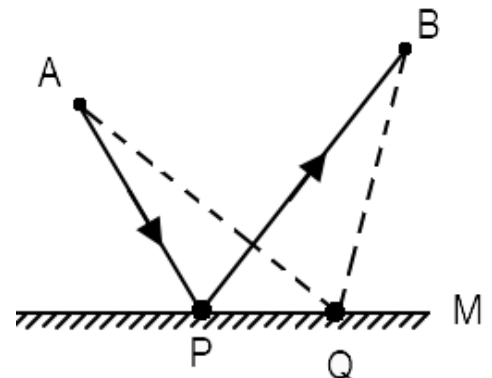
177. Photons of wavelength λ cause the emission of photoelectrons from a metallic surface, the de-Broglie wavelength of the fastest photoelectron being λ_d . A graph of $\frac{1}{\lambda}$ vs $\frac{1}{\lambda_d}$ is

1. a straight line passing through the origin.
2. a circle.
3. an ellipse.
4. a parabola.

178. Among the given options which is the minimum work function so that light from the Balmer series will not be able to cause any photo-electric effect?

1. 13.6 eV
2. $\frac{13.6}{2}$ eV
3. $13.6 \times \left(\frac{3}{4}\right)$ eV
4. $13.6 \times \left(\frac{1}{4} - \frac{1}{9}\right)$ eV

179. The following diagram shows light travelling from A to B after bouncing off a plane mirror at P. The time taken is t_{APB} . If, however, light were to take a different path, AQB (shown by the dotted line), the time taken is t_{AQB} . Then,



1. $t_{APB} = t_{AQB}$
2. $t_{APB} < t_{AQB}$
3. $t_{APB} > t_{AQB}$
4. t_{APB} maybe greater than or less than t_{AQB} depending on whether Q is to the left or right of P.

180. Radiation from hydrogen atom making transitions from state $n = 2$ to $n = 1$, falls on a gas containing Li^{2+} ions in $n = 1, 2, 3$ states. Which of the following statements is correct?

1. Some radiation is absorbed by Li^{2+} ions in $n = 2$ state.
2. Some radiation is absorbed by Li^{2+} ions in $n = 3$ state.
3. Some radiations is absorbed by Li^{2+} ions in $n = 1$ state.
4. None of the radiation is absorbed by Li^{2+} ions.

181. **Assertion (A) :**

Parallel rays of light of different colors fail to converge to a point after reflection from a spherical mirror.

Reason (R) :

The refractive index of any material depends on the frequency of light.

1. The (A) is true but the (R) is false.
2. The (A) is false but the (R) is true.
3. Both the (A) and the (R) are true and the (R) is a correct explanation of the (A).
4. Both the (A) and (R) are true but the (R) is not a correct explanation of the (A).

182. White light is used to illuminate the double slit, in Young's double-slit experiment. Then, which of the following is/are true?

- (I) The central fringe will be white.
 (II) Closest to the central fringe will be a violet fringe.
 (III) There will not be any dark fringe.
1. I only
 2. I, II
 3. I, III
 4. I, II, III

183. The electric field associated with a light wave is given by $E = E_0 (\sin\omega_1 t) (\sin\omega_2 t)$.

This light wave falls on a metal having a threshold frequency, ν_0 . The maximum kinetic energy of the emitted photoelectrons will be: (h is Planck's constant)

1. Either $\frac{h\omega_1}{2\pi}$ or $\frac{h\omega_2}{2\pi}$
2. Either $\left(\frac{h\omega_1}{2\pi} - h\nu_0\right)$ or $\left(\frac{h\omega_2}{2\pi} - h\nu_0\right)$
3. $\frac{h(\omega_1+\omega_2)}{2\pi} - h\nu_0$
4. Both $\frac{h(\omega_1+\omega_2)}{2\pi} - h\nu_0$ and $\frac{h|\omega_1-\omega_2|}{2\pi} - h\nu_0$

184. A small object is placed on the principal axis of a convex lens and it forms a real image with a (transverse) magnification of 2. If the object were to move perpendicular to the principal axis with a speed u , the speed of the image will be:

1. u
2. $u/2$
3. $2u$
4. $4u$

185. The half-life of a radioactive sample is $T_{1/2}$. If we define $\frac{1}{3}$ -life ($T_{1/3}$) as the time in which the activity of the sample reduces to $\frac{1}{3}$ rd of its initial value, then:

- (1) $T_{1/2} = \frac{2}{3}T_{1/3}$
- (2) $T_{1/2} = \sqrt{\frac{2}{3}} T_{1/3}$
- (3) $\frac{T_{1/2}}{\ln 2} = \frac{T_{1/3}}{\ln 3}$
- (4) $T_{1/2} \cdot \ln 2 = T_{1/3} \ln 3$

Physics - Section B

186. In a transistor, the impurity concentration is highest in

1. emitter
2. base
3. collector
4. none of these, as all have the same concentration.

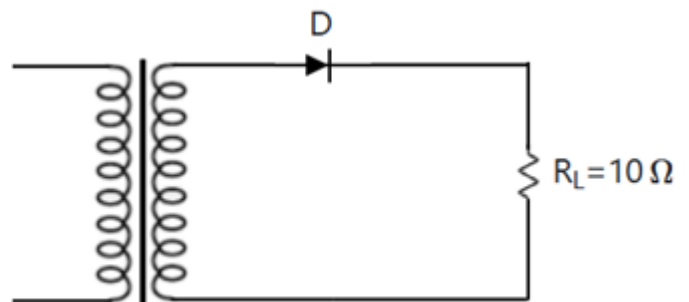
187. When a transistor is working as an amplifier, the bias across the junctions are as follows (E = Emitter, B = Base, C = Collector)

1. EB: reverse bias, CB: reverse bias
2. EB: forward bias, CB: reverse bias
3. EB: reverse bias, CB: forward bias
4. EB: forward bias, CB: forward bias

188. Which of the following gates, may be used to form all other gates?

1. AND
2. OR
3. NOT
4. NAND

189. A 10:1 step-down transformer has an ideal diode and a 10Ω resistance connected to its secondary circuit while 220 V AC mains is applied to the primary.

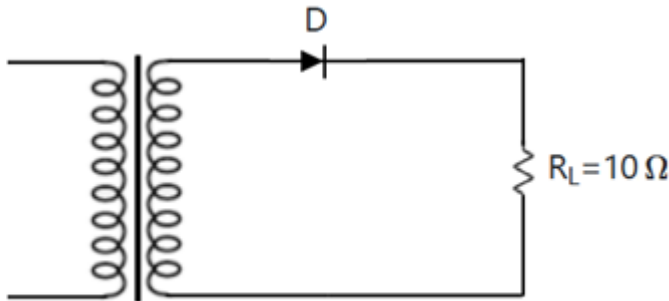


(10:1 step-down)

Assuming the transformer to be ideal, the current in the primary circuit when the diode is reverse-biased is:

1. 0.22 A
2. $\frac{0.22}{\sqrt{2}} \text{ A}$
3. $0.22\sqrt{2} \text{ A}$
4. zero

190. A 10:1 step-down transformer has an ideal diode and a $10\ \Omega$ resistance connected to its secondary circuit while 220 V AC mains is applied to the primary.



(10:1 step-down)

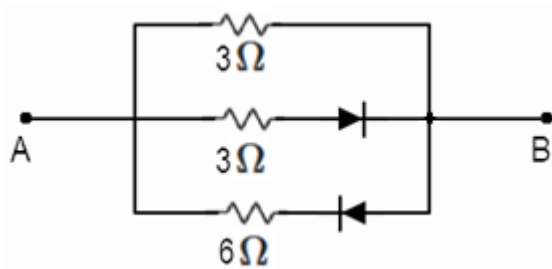
The peak reverse voltage across the diode is:

1. 220 V
2. $22\sqrt{2}$ V
3. $\frac{22}{\sqrt{2}}$ V
4. $44\sqrt{2}$ V

191. The α_{ac} of a transistor is 0.99. The base current through the transistor changes by $10\ \mu A$. The collector current changes by:

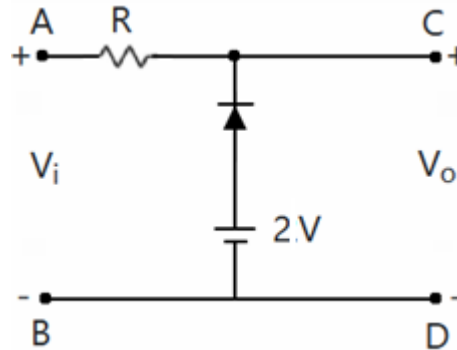
1. $9.9\ \mu A$
2. $1\ \mu A$
3. $99\ \mu A$
4. $990\ \mu A$

192. The equivalent resistance between A and B of the network shown below is:



1. $1.2\ \Omega$
2. $3\ \Omega$
3. $1.5\ \Omega$ if $V_A > V_B$ and $2\ \Omega$ if $V_A < V_B$
4. $2\ \Omega$ if $V_A < V_B$ and $1.5\ \Omega$ if $V_A > V_B$

193. In the circuit shown in the diagram given below, R is a small resistor. V_i is the input voltage between A & B while V_o is the output voltage between C & D.

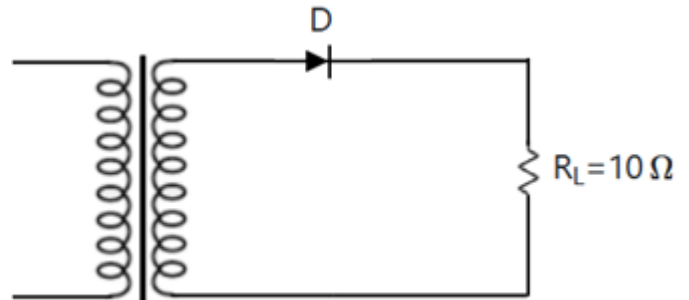


Consider the following two statements and mark the correct option.

- (I) If $V_i > 2$ V, then $V_o = V_i$
- (II) If $V_i < 2$ V, then $V_o = 2$ V

1. I is true.
2. II is true.
3. I, II are both true.
4. I, II are both false.

194. A 10:1 step-down transformer has an ideal diode and a $10\ \Omega$ resistance connected to its secondary circuit while 220 V AC mains is applied to the primary.



(10:1 step-down)

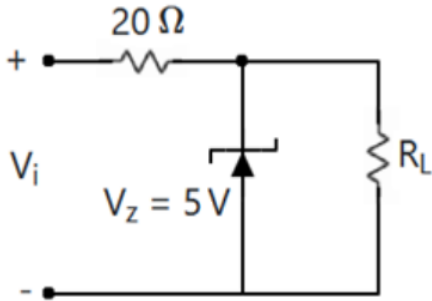
The maximum circuit current through the load resistance is:

1. 22 A
2. 2.2 A
3. $2.2\sqrt{2}$ A
4. $\frac{2.2}{\sqrt{2}}$ A

195. A load resistance is connected to a full-wave rectifier and the peak current through the load is I_o . The rms current through the load resistor is:

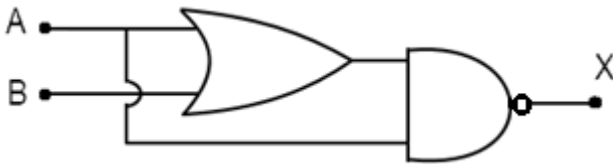
- (1) $\frac{I_o}{\sqrt{2}}$
- (2) $2\left(\frac{I_o}{\sqrt{2}}\right)$
- (3) I_o
- (4) None of the above

196. Consider the circuit shown in the figure given below. The input voltage is V_i , the current through the diode is I_z , and the current through the load is I_L .



1. If $V_i = 15\text{ V}$ and $R_L = 40\ \Omega$, then $I_z = 0.375\text{ A}$
2. If $V_i = 10\text{ V}$ and $R_L = 5\ \Omega$, then $I_L = 1\text{ A}$
3. If $V_i = 20\text{ V}$ and $R_L = 20\ \Omega$, then $I_z = 0.25\text{ A}$
4. If $V_i = 20\text{ V}$ and $R_L = 10\ \Omega$, then $I_z = 0.5\text{ A}$

197. By writing down the truth-table or otherwise, determine the output X of the circuit given below



1. A
2. B
3. A or B
4. NOT (A)

198. We compare npn and pnp transistors: let f represent the fraction of the total current carried by electrons within the transistors.

1. $f(\text{nnp}) > f(\text{pnp})$
2. $f(\text{nnp}) < f(\text{pnp})$
3. $f(\text{nnp}) = f(\text{pnp})$
4. Any of the above may be true depending upon the temperature of the transistors.

199. **Assertion (A) :**

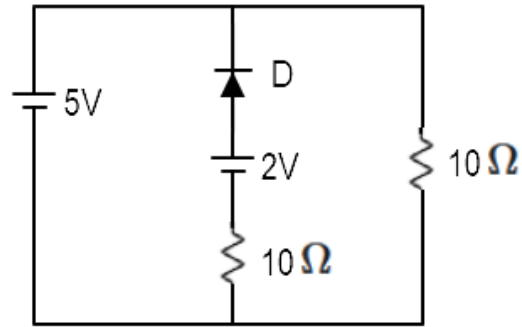
The resistance of a photodiode decreases when light having photons of sufficient energy is incident on it.

Reason (R) :

When energetic photons fall on the p-n junction of a photodiode, electron-hole pairs are created due to breaking of the valence bonds.

1. The (A) is true but the (R) is false.
2. The (A) is false but the (R) is true.
3. Both the (A) and the (R) are true and the (R) is a correct explanation of the (A).
4. Both the (A) and (R) are true but the (R) is not a correct explanation of the (A).

200. What will be the change in the current through the 5 V cell if the diode D is reversed?



1. No change
2. Increases by 0.2 A
3. Increases by 0.3 A
4. Decreases by 0.2 A

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