# Botany - Section A

1. An intervening dikaryophase is seen during the sexual reproduction in members of the fungal class:
1. Phycomycetes and Ascomycetes
2. Ascomycytes and Basidiomycetes
3. Basidiomycetes and Deuteromycetes
4. Phycomycetes and Deuteromycetes

2. The number of carbon atoms in all the following molecules is 4 except in:
1. α ketoglutaric acid
2. Oxaloacetic acid
3. Succinic acid
4. Malic acid

3. Different types of leaves in different phases of life in cotton, coriander and larkspur is an example of:
1. Pleiotropy
2. Phenotypic plasticity
3. Developmental noise
4. Polygenic trait

4. Pusa Sawani and Pusa A-4 are improved varieties of:
1. Okra [Bhindi] and are resistant to fruit and shoot borer
2. Flat bean and are resistant to Jassids and Aphids
3. Cow pea and are resistant to bacterial blight
4. Wheat and are resistant to hill bunt

5. All the following statements regarding collenchyma in plants is true except:
1. Occurs in layers below the epidermis in most of the dicotyledonous plants
2. Cells are thickened at the corners due to deposition of cellulose, hemicelluloses and pectin
3. There is considerable amount of intercellular space between cells
4. Provide mechanical support to the growing parts of the plants

6. The innermost layer of the cortex in the roots that restricts the apoplastic transport of water inside is called as:
1. Hypodermis
2. Endodermis
3. Pericycle
4. Stele

7. Which of the following is a dominant trait in Pisum sativum?
1. Yellow pod colour
2. Green seed colour
3. Axial flower position
4. Constricted pod shape

8. When the ratio of carbon dioxide and oxygen in the vicinity of RuBisCO is 1, the affinity of the enzyme:
1. is nearly nil for oxygen
2. is about equal for both carbon dioxide and oxygen
3. is much greater for oxygen than carbon dioxide
4. is much greater for carbon dioxide than oxygen

9. In a plant cell:
1. there are multiple vacuoles, each small in size
2. centrioles play prominent role in organization of microtubules
3. cytokinesis occurs through cleavage furrow
4. Secondary cell wall is formed on the inner [towards membrane] side of the cell

10. The strength of linkage between two genes will be:
1. higher if the genes are farther from each other
2. higher if the genes are closer to each other
3. higher if ganetic coupling is present
4. higher if ganetic repulsion is present

11. All the following are correct regarding Methanogens except:
1. They can grow anaerobically on cellulosic material
2. They can produce large amounts of methane along with carbon dioxide and hydrogen
3. They can be found in anaerobic sludge during sewage treatment and in rumen of cattle
4. They are true bacteria and are chemoheterotrophs

12. During glycolysis in plant cells, the enzyme hexokinase catalyzes the phosphorylation of:
I. Glucose
II. Fructose

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

13. It is possible to induce mutations artificially through the use of radiations. Which of the following is especially suitable for inducing mutations in plants?
1. X rays
2. UV rays
3. γ rays
4. PEG

14. Study the given diagram and select the best option:
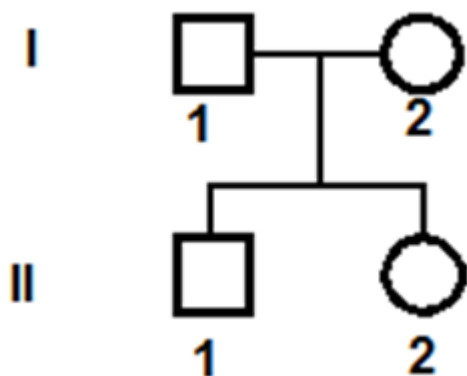
1. The mating between I-1 and I-II is consanguineous
2. The first born child of I-1 and I-II is a male
3. The first born child of I-1 and I-II is a female
4. The first born child of I-1 and I-II is affected by a genetic disease

15. Bacteria capable of carrying out reduction of nitrate present in the soil include:
1. Pseudomonas and Thiobacillus
2. Nitrosomanas and Nitrobacter
3. Nitrococcus and Nitrococcus
4. Rhizobium and Bradyrhizobium

16. The reducing power used in Calvin cycle for reduction of carbon dioxide is:
1. NADH
2. NADPH
3. ATP
4. Water

17. Seed plants where separate male and female cones or flowers are present on the same plant are called as:
1. staminate
2. pistillate
3. dioecious
4. monoecious

18. Which of the following, though a characteristic, cannot be a defining property of living organisms?
I. Growth
II. Reproduction
III. Cellular organization with metabolism
IV. Consciousness

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

19. What is not true regarding diffusion in context of biology?
1. Molecules move in a random fashion with a net result that substance move from regions of higher concentration to regions of lower concentration.
2. No ATP energy expenditure takes place.
3. It is a very rapid process dependent on a living system.
4. It is the only means for gaseous transport in plant cells.

20. Which of the following is/are a correct match?

| I. | Bulliform cells | large, bubble-shaped epidermal cells that occur in groups on the upper surface of the leaves of many monocots. |
| II. | Lenticells | a porous tissue consisting of cells with large intercellular spaces in the periderm of the secondarily thickened organs and the bark of woody stems and roots of dicotyledonous flowering plants |

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

21. Identify the incorrect statement:
1. Ray florets of sunflower have epigynous flowers with inferior ovary.
2. In vexillary aestivation, keel are the two largest posterior petals
3. Stamens are united into one bunch in China rose
4. Placentation is marginal in Pea.

22. What provides the electrons needed to replace those removed from photosystem II during non cyclic photophosphorylation?
1. PS I
2. Oxygen
3. Water
4. Carbon dioxide

23. The sporophyte of mosses is more elaborate than that in:
1. Pteridophytes
2. Gymnosperms
3. Angiosperms
4. Liverworts

24. For plants the elements such as sodium, cobalt, silicon and selenium be best described as:
1. Beneficial elements
2. Toxic elements
3. Trace elements
4. Macronutrient elements

25. The cell wall of the cells of an alga has cellulose and algin. Another feature expected in this alga would be:
1. Floridean starch as stored food
2. Phycoerythrin in addition to chlorophyll a, c
3. 2, unequal, lateral flagellar insertions
4. Polysulphate esters in cell wall

26. PGRs can be broadly divided into two groups – plant growth promoters and plant growth inhibitors. Ethylene:
1. belongs to the group of plant growth promoters
2. belongs to the group of plant growth inhibitors
3. could fit either of the groups, but is largely an inhibitor of growth activities
4. could fit either of the groups, but is largely a promoter of growth activities

27. Which of the following is/are a correct match?

	Fabaceae	Solanaceae
I. Ovary	Inferior	Monocarpellary unilocular
II. Fruit	Endospermous	Non-endospermic

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

28. Identify the correct statement:
1. Roquefort cheese is ripened by a growing a specific bacterium on them
2. LAB improves the nutritional quality of curd by increasing Vitamin A.
3. Aspergillus niger is used for commercial production of citric acid
4. Statins are used to lower blood glucose levels in IDDM

29. Accessory pigments of photosynthesis in higher plants:
I. include chlorophyll b, xanthophylls and carotenoids.
II. absorb light and transfer electrons to chlorophyll a.
III. protect chlorophyll a from photo-oxidation.
1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

30. A pure tall plant is crossed with a hybrid tall plant [tall completely dominant over dwarf]. What proportion of progeny is expected to be dwarf?
1. 0
2. ½
3. ¼
4. ¾

31. Abnormally folded infectious proteins can, in humans, cause:
1. Mad cow disease
2. Scrapie
3. Creutzfeldt-Jacob disease
4. MERS

32. Antipodal is an adjective that means 'diametrically opposite'. Where are the antipodal cells located in an embryosac of an angiosperm?
1. At the micropylar end
2. At the chalazal end
3. In the middle
4. There are three – one at micropylar and two at chalazal end

33. What would be incorrect for phloem in angiosperms?
1. Phloem fibres, at maturity, lose their protoplasm and become dead.
2. The function of sieve tubes is controlled by the nucleus of companion cell.
3. The direction of movement in the phloem can be bi-directional.
4. Phloem sap is mainly water and starch.

34. Palisade parenchyma:
1. are prominent in isobilateral leaf
2. is abaxially placed in dorsi-ventral leaf
3. are loosely arranged oval or round cells extending to the lower epidermis in dorsi-ventral leaf
4. is made of elongated cells vertically arranged parallel to each other in dorsi-ventral leaf

35. Identify the incorrect statement regarding heterotrophic bacteria?
1. They are most abundant bacteria in nature
2. Many of them are important decomposers
3. They play a great role in recycling nutrients like nitrogen, phosphorus, iron and sulphur
4. They have chlorophyll a similar to green plants

Botany - Section B

36. Which of the following would be the oldest in the given periods of geological time scale?
1. Carboniferous
2. Permian
3. Triassic
4. Jurassic

37. Any gas that absorbs incoming solar radiation or outgoing infrared radiation is called as radiatively active gas. One of such gases which is major contributor to total global warming is:
1. Carbon dioxide
2. Methane
3. CFCs
4. N_2O

38. Which of the following seral stages represents the stage that is seen in a typical primary hydrarch succession just before the establishment of final forest stage?
1. Marsh-meadow stage
2. Scrub stage
3. Reed-swamp stage
4. Submerged free-floating plant stage

39. Identify the incorrect statement:
1. Amazon rain forest produces 20% of total oxygen in the Earth's atmosphere
2. All the biodiversity hotspots put together cover about 10 % of the Earth's land area
3. About 31 % of all gymnosperms species in the world face the threat of extinction
4. India's share of the global species diversity is about 8.1 %

40. In some plants buds can grow where it normally would not. One such location may be in the margins of leaves. Name a plant where such buds are used as vegetative propagules:
1. *Eichhornia crassipes*
2. *Bryophyllum*
3. *Rhizophora*
4. *Amorphophallus*

41. Sacred groves of Khasi and Jaintia hills are located in:
1. Assam
2. Meghalaya
3. Manipur
4. Arunachal Pradesh

42. Regarding energy flow in an ecosystem:
1. About 2 to 10 % of incident solar radiation is PAR
2. An ecosystem is exempt from the Second Law of Thermodyanamics
3. The amount of energy increases at successive trophic levels
4. The number of trophic levels in a grazing food chain is limited

43. Of the total cost of various ecosystem services, the cost of climate regulation and habitat for wildlife is about:
1. 6 %
2. 10 %
3. 12 %
5. 50 %

44. Both Xylem and Phloem are complex tissues. At maturity, the living component of xylem and the dead component of phloem respectively are:
1. Xylem parenchyma and Phloem parenchyma
2. Xylem parenchyma and Phloem fibres
3. Xylem fibres and Phloem fibres
4. Xylem fibres and Phloem parenchyma

45. Consider the following statements:
I. Among invertebrates maximum species richness is seen in insects
II. Among vertebrates maximum species richness is seen in mammals
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

46. What is not true regarding the Montreal Protocol?
1.   It is an international treaty designed to protect the ozone layer
2.   It was signed in 1987
3.   It entered into force on 1 January 1989.
4.   Same roadmap was developed for both developed and developing countries for reducing ozone depleting substances

47. What are the consequences of deforestation?
I.   Enhanced carbon dioxide concentration in the atmosphere
II.   Loss of biodiversity
1.   Only I
2.   Only II
3.   Both I and II
4.   Neither I nor II

48. What is the minimum percentage of impurities present that makes domestic sewage unfit for human use?
1.   0.1
2.   1.0
3.   5.0
4.   10.0

49. Identify the option where the features are correctly matched to types with respect to mustard:

Flower symmetry	Ovary position	Androecium	Gynoecium
1. Zygomorphic	Inferior	Variable length stamens within a flower	Parietal placnetation
2. Zygomorphic	Inferior	Polyadelphous	Marginal placentation
3. Actinomorphic	Superior	Polyadelphous	Axile placentation
4. Actinomorphic	Superior	Variable length stamens within a flower	Parietal placnetation

50. The net primary productivity of oceans is about:
1.   25 % of the annual net primary productivity of the whole biosphere
2.   33 % of the annual net primary productivity of the whole biosphere
3.   66 % of the annual net primary productivity of the whole biosphere
4.   70 % of the annual net primary productivity of the whole biosphere

Zoology - Section A

51. The frequency of a recessive allele in a population at genetic equilibrium is 0.3. What is the frequency of homozygous dominant genotype in this population?
1. 0.49
2. 0.09
3. 0.21
4. 0.7

52. Regarding the male accessory sex ducts:
1. About 200 seminiferous tubules are present in testis lobule
2. Epididymis is located along the anterior surface of each testis
3. Vas deferens ascends to the abdomen and loops over the bladder
4. Ducts of seminal vesicles open at the urethral meatus

53. Identify the incorrectly matched pair:

1. Ciliated epithelium	Fallopian tubes
2. Dense irregular connective tissue	Skin
3. Nissl's granules	Neuron
4. Smooth muscle	Intercalated disc

54. In the diffusion membrane in human lungs, a basement membrane supports:
I. Alveolar epithelium
II. Vascular endothelium
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

55. Chylomicrons are:
1. lipid coated proteinoid mixtures
2. protein coated fat globules
3. glycoprotein coated nucleic acids
4. closed bilayer structures spontaneously formed by hydrated phospholipids

56. All enzymes are:
1. Proteins
2. Thermostable
3. Capable of speeding up a biochemical reaction
4. Capable of working in alkaline pH

57. What is incorrect regarding human heart?
1. It is neurogenic
2. It is derived from embryonic mesoderm
3. It is a muscular pump
4. It is located in thorax between the lungs

58. A cardiovascular centre that can moderate the cardiac function through the autonomic neural system is located in the:
1. Pons varoli
2. Medulla oblongata
3. Hypothalamus
4. Cerebrum

59. Identify the incorrect statement regarding the ultra-structure of a skeletal muscle:
1. Z lines bisect the I band
2. G actin is a polymer of F actins
3. A subunit of troponin masks active binding sites for myosin on the actin filament.
4. Globular head of myosin has ATPase activity.

60. In the human eye:
1. the choroid is avascular
2. lens is held in place by ligaments attached to the ciliary body
3. photopic vision and colour perception is a function of rods
4. aqueous humor has a gel-like consistency

61. The central nervous system in chordates is not:
1. Single
2. Hollow
3. Ventral
4. Derived from embryonic ectoderm

62. A person suffering from Klinefelter's syndrome:
1. has 45 autosomes
2. is likely to have short stature and webbed neck
3. can develop Gynecomastia
4. have normal fertility

63. Regarding 'Saheli':
I. It is a steroidal oral contraceptive pill developed by CDRI
II. It has very few side effects and high contraceptive value
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

64. A fluid-filled cavity called as 'antrum' is characteristically seen in a:
1. Secondary follicle
2. Tertiary follicle
3. Morula
4. Blastocyst

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

COLUMN I		COLUMN II
A	Comb plates	P	Cnidaria
B	Metagenesis	Q	Mollusca
C	Canal system	R	Sponges
D	Radula	S	Ctenophora

Codes:

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

66. Triploblastic, bilaterally symmetrical animals with true coelom but no segmentation are:
1. Aschelminthes
2. Molluscs
3. Annelids
4. Chordates

67. Which of the following conditions can be caused by exposure to allergens?
1. Asthma
2. Rheumatoid arthritis
3. Japanese encephalitis
4. Leukaemia

68. Identify the correctly matched pair:

1.	Hyposecretion of growth hormone in adults	Acromegaly
2.	Lack of insulin	Diabetes insipidus
3.	Hyperthyroidism	Graves' disease
4.	Hypocortisolism	Cushing's disease

69. Inspiration during breathing occurs when the pressure in lungs is:
1. Zero
2. Negative with respect to atmospheric pressure
3. Equal to atmospheric pressure
4. Positive with respect to atmospheric pressure

70. Consider the given two statements:
I. In a neuron, Nissl's granules are present in dendrites as well as cell body
II. Unmyelinated neurons in peripheral neural system are not enclosed by a Schwann cell
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

71. Cells in the human body that secrete products like lipids and steroids are likely to have an abundance of:
1. Smooth endoplasmic reticulum
2. Rough endoplasmic reticulum
3. Lysosomes
4. Mitochondria

72. Karl Ernst von Baer:
1. conducted a control experiment to disprove spontaneous generation
2. proposed the concept of pangenesis as the physical basis of heredity
3. disapproved the proposal of Ernst Haeckel [Biogenetic law]
4. was one of the rediscoverers of Mendel's laws

73. A steroid hormone when released increases blood glucose level, causes lipolysis and proteolysis, retards cellular uptake and utilization of amino acids by body cells and has a potent anti-inflammatory effect. This hormone is:
1. Thyroxin
2. Adrenaline
3. Growth hormone
4. Cortisol

74. Droplets can be the mode of transmission of pathogens causing all the following diseases except:
1. Ascariasis
2. Pneumonia
3. Common cold
4. Covid-19

75. Gastric glands do not secrete:
1. Proteolytic enzymes
2. Hormone
3. Lipases
4. Amylases

76. What type of chromosomes will not have a short and a long arm?
1. Acrocentric
2. Metacentric
3. Sub-metacentric
4. Both 1 and 2

77. ADH:
I. is released when an excessive loss of fluid from the body activates osmoreceptors in the body.
II. prevents dieresis by facilitating water reabsorption from the initial and proximal parts of the tubules.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

78. The number of:
1. Aromatic proteinogenic amino acids is 5
2. Carbon atoms in arachidonic acid including carboxyl carbon is 20
3. Fatty acids in cholesterol is 3
4. Polypeptide chains in quaternary structure of haemoglobin is 2

79. Who amongst the following was an American scientist?
1. J. B. S. Haldane
2. Alexander Oparin
3. Charles Darwin
4. Stanley L. Miller

80. Which of the following is not guarded by the presence of a sphincter?
1. Opening of Oesophagus into Stomach
2. Opening of Stomach into Duodenum
3. Opening of Ileum into Jejunum
4. Opening of common hepato-pancreatic duct into duodenum

81. Thrombokinase:
1. is an enzyme formed in and secreted by the platelets
2. is an enzyme complex required to convert prothrombin into thrombin
3. dissolves the intravascular clots
4. prevents coagulation of the blood

82. Which of the following is not a correctly matched pair?
1. Ear ossicles   Total 6 in number
2. Pubic symphysis Fibrous cartilage
3. Gliding joint   Between atlas and axis vertebrae
4. Scapula   Glenoid cavity

83. Regarding nervous system of Cockroach:
1. Most of it is held in the head region.
2. The brain is represented by sub-oesophageal ganglion
3. It is located on the dorsal side of the body
4. Compound eyes provide mosaic vision

84. Nephrons closest to the renal medulla are called:
1. Cortical
2. Medullary
3. Juxta-medullary
4. Proto-nephridia

85. Which structure enables the communication between the left and right cerebral hemispheres in the human brain?
1. Foramen of Monroe
2. Cerebral aqueduct of Sylvius
3. Corpus callosum
4. Cerebellar peduncles

Zoology - Section B

86. The polymerase chain reaction:
I. is used to synthesize multiple copies of the gene [or DNA] in vitro
II. uses a thermostable DNA dependent DNA polymerase
III. is now routinely used to detect HIV in suspected AIDS patient.
IV. is being used to detect mutations in genes in suspected cancer patients.
1. All except I are true
2. Only II and III are true
3. Only IV is not true
4. I, II, III and IV are true

87. Match Scientists in Column I with their main discipline/contribution in Column II and select the correct match from the codes given:

COLUMN I		COLUMN II
A	Ramdeo Misra	P	Ecology
B	M. S. Swaminathan	Q	Green revolution
C	Panchanan Maheshwari	R	Plant embryology
D	G N Ramachandran	S	Collagen structure

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

88. Which of the following is not true regarding spleen?
1. It is a primary lymphoid organ.
2. It has a large reservoir of erythrocytes.
3. It mainly contains lymphocytes and phagocytes.
4. It is a large bean shaped organ in the left upper quadrant of the abdomen.

89. Identify hominids who were cave dwellers, used hides to protect their bodies and buried their dead:
1. Homo erectus
2. Homo sapiens
3. Homo neanderthalensis
4. Homo habilis

90. Identify the incorrect statement:
1. Both AIDS and Hepatitis B can be transmitted through sexual contact or infected blood.
2. Chronic use of alcohol can lead to cirrhosis of liver.
3. Nicotine stimulates adrenal cortex to secrete corticosteroids.
4. Morphine is a very effective sedative and painkiller.

91. What is the major problem regarding the livestock of India?
1. The population is very low.
2. The productivity per unit is low.
3. They are not adapted to hot conditions of Indian subcontinent.
4. They have the lowest life span amongst the livestock in the world.

92. Mule:
1. is an interspecific hybrid
2. is fertile
3. do not exhibit hybrid vigour
4. is not of any economic value

93. The strain of Escherechia coli from which the restriction enzyme EcoR I has been isolated is:
1. DH5α
2. RY 13
3. NC101
4. K1

94. Biopiracy is:
1. the exploration of natural sources for small molecules, macromolecules and biochemical and genetic information that could be developed into commercially valuable products.
2. exploitation of a region's biological resources or indigenous knowledge unethically and without providing fair compensation.
3. the use of living organisms, like microbes and bacteria, in the removal of contaminants, pollutants, and toxins from soil, water, and other environments
4. the process of developing a crop with bioavailable micronutrients in its edible parts.

95. One of the strands of a dsDNA molecule has 5 adenine and 5 cytosine bases. The number of hydrogen bonds in this dsDNA molecule is expected to be:
1. 10
2. 20
3. 25
4. 30

96. Identify the incorrectly matched pair:
1. CT   Computed Tomography
2. MRI   Magnetic Radiation Imaging
3. NACO   National AIDS Control Organization
4. MALT   Mucosa Associated Lymphoid Tissue

97. Which of the following is a free-living non-pathogenic nematode, frequently used in the study of developmental genetics, and whose genome has been sequenced?
1. *Arabidopsis thaliana*
2. *Caenorhabditis elegans*
3. *Drosophila melanogaster*
4. *Meloidogyne incognitia*

98. HIV:
I. uses phagocytic neutrophils as factory to produce more virus particles.
II. destroys B lymphocytes selectively.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

99. Under normal physiological conditions, what percent of haemoglobin is saturated with oxygen when the partial pressure of oxygen is 40 mm Hg?
1. 50
2. 75
3. 90
4. 98

100. While cutting dsDNA the progression of a restriction enzyme digestion can be checked by employing:
1. Agarose gel electrophoresis
2. FISH
3. Ethidium bromide
4. Autoradiography

Chemistry - Section A

101. In case of a colloidal solution, if both liquid dispersed phase and liquid dispersion medium are present, then it is known as
1. Gel
2. Sol
3. Emulsion
4. Foam

102. When ZnO is heated then it gives the appearance of yellow colour. It is due to
1. Metal excess defect
2. Metal deficiency defect
3. Schottky defect
4. Frenkel defect

103. Which of the following carboxylic acids can give Hell Volhard Zelinsky (HVZ) reaction?
1. HCOOH
2. 2,2-dimethyl propanoic acid
3. Benzoic acid
4. Propanoic acid

104. Which of the following alkali metal has the lowest density?
1. Na
2. K
3. Rb
4. Cs

105. On dilution, specific conductivity of the solution
1. Decreases
2. Increases
3. Remains same
4. Cannot be predicted

106. On complete hydrolysis, XeF_6 gives
1. Xe
2. XeO_3
3. $XeOF_4$
4. XeO_2F_2

107. Which of the following compounds is the main cause of depletion of ozone layer?
1. CCl_4
2. Freons
3. Chloretone
4. Chloroform

108. When $CuSO_4$ solution using copper electrodes is electrolysed, pH of the solution
1. Increases
2. Decreases
3. Remains the same
4. Firstly increases and then decreases

109. For which gas, the value of compressibility factor (Z) is greater than 1?

1. H_2
2. He
3. NH_3
4. Both (1) and (2)

110. An amine reacts with benzene sulphonyl chloride to form solid compound which is soluble in alkali. The amine may be
1. $(CH_3)_2NH$
2. $(CH_3)_3N$
3. $CH_3 - CH_2 - NH_2$
4. $CH_3 - NH - CH_2 - CH_3$

111. Inversion of cane sugar is an example of
1. Unimolecular reaction
2. Pseudounimolecular reaction
3. Bimolecular reaction
4. Second order reaction

112. Which of the following solutions has the minimum freezing point?
1. 0.02 M NaCl
2. 0.05 M Urea
3. 0.01 M $MgCl_2$
4. 0.01 M KCl

113. Maximum value of the rate constant can be achieved by
1. decreasing the activation energy to zero
2. increasing the temperature up to infinity
3. both 1 and 2
4. decreasing the Arrhenius constant

114. Acetic acid dimerises in benzene solution. The value of Van't Hoff factor (i) for the dimerisation of acetic acid is 0.6. Therefore, the percentage of dimerisation of acetic acid will be
1. 20%
2. 40%
3. 60%
4. 80%

115. Aqueous solution of which of the following salts is not a neutral solution?
1. $NaCl$
2. CH_3COONH_4
3. Na_2SO_4
4. None of these

116. In $[Cr(NH_3)_6][Co(CN)_6]$, the oxidation state of Cr and Co, respectively, are
1. 0 and +6
2. +2 and +4
3. +3 and +3
4. +4 and +2

117. Which of the following alkanes has the highest melting point?
1. n-pentane
2. Isopentane
3. Neopentane
4. Butane

118. The orbital angular momentum for p-orbital is

1. Zero
2. $\sqrt{2}\,\hbar$
3. $\sqrt{6}\,\hbar$
4. $\sqrt{24}\,\hbar$

119. When chromite ore is heated with Na_2CO_3 and O_2 then the compound of chromium formed and its colour, respectively, are
1. Na_2CrO_4 , yellow
2. $Na_2Cr_2O_7$, yellow
3. Na_2CrO_4 , orange
4. $Na_2Cr_2O_7$, orange

120. pH of $10^{-7}\,M\,NaOH$ solution at 25°C will be
1. 7
2. 6.7
3. 7.3
4. 8.3

121. When but-2-yne is reacted with H_2 in presence of Lindlar's catalyst, the product formed is
1. Butane
2. But-1-ene
3. Cis-but-2-ene
4. Trans-but-2-ene

122. The strongest bond is

1. $sp^3 \overset{\sigma}{-} sp^3$
2. $sp^2 \overset{\sigma}{-} sp^2$
3. $sp \overset{\sigma}{-} sp$
4. $p \overset{\pi}{-} p$

123. When hydrated barium peroxide is reacted with ice cold H_2SO_4 then H_2O_2 is formed. In hydrated barium peroxide, the number of water of crystallisation is
1. 2
2. 4
3. 6
4. 8

124. The most acidic compound amongst the following is
1. o-cresol
2. m-cresol
3. p-cresol
4. o-xylene

125.
For the reaction, $2A + B \longrightarrow 3C$, 8 mole of A reacts with 5 mole of B to form C. How many maximum moles of C are formed?

1. 13 mole
2. 15 mole
3. 12 mole
4. 8 mole

126. Which of the following carbohydrates is laevorotatory in nature?
1. Glucose
2. Fructose
3. Mannose
4. Sucrose

127. The formal charge of S in SO_3 will be

1. Zero
2. $+1$
3. $+2$
4. $+6$

128. For the spontaneity of freezing of water, which condition must be imposed?
1. $\Delta H > T\Delta S$
2. $\Delta H < T\Delta S$
3. $\Delta H = T\Delta S$
4. Freezing of water is always non-spontaneous

129. Amongst the following compounds, ferrimagnetic substance is
1. CrO_2
2. Fe_3O_4
3. MnO
4. FeO

130. Which of the following halogens has the highest negative electron gain enthalpy?

1. F
2. Cl
3. Br
4. I

131. The purest form of iron is
1. Cast Iron
2. Wrought Iron
3. Pig Iron
4. Steel

132. Amongst the given trioxides of nitrogen, the amphoteric oxide is
1. P_2O_3
2. Sb_2O_3
3. Bi_2O_3
4. None of the above

133. Which of the following solvents favours S_N2 mechanism?
1. Non polar solvent
2. Polar protic solvent
3. Polar aprotic solvent
4. All of these

134. Formaldehyde is reacted with ethyl magnesium bromide followed by hydrolysis. The product formed will be
1. Methanol
2. Ethanol
3. Propanol
4. Propan-2-ol

135. The oxidation number of 'P' in $Ca(H_2PO_2)_2$ will be
1. -1
2. 0
3. +1
4. +3

Chemistry - Section B

136. The most stable carbanion is

1.

2.

3.

4.

137.
$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O + xK.cal$$
The value of x will be
1. 13.7
2. 27.4
3. Less than 13.7
4. More than 27.4

138. Given the reaction:
$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$
In this reaction, equivalent weight of HCl will be
1. 36.5
2. 73
3. 18.25
4. 54.75
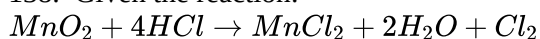
139. 'Pearl ash' is
1. Na_2CO_3
2. $NaNO_3$
3. K_2CO_3
4. KNO_3

140. When formaldehyde is reacted with NH_3, then Urotropine is formed. It is used as an
1. Antipyretic
2. Analgesic
3. Antiseptic
4. Antimalarial

141. Which has the highest mass?
1. 2.24 l SO_2 gas at NTP
2. 0.4 mole NO_2 gas
3. 3.01×10^{22} molecules of CO_2 gas
4. 5 gm Fe

142. Which of the following ions is the largest in size?
1. Li$^+$(aqueous)
2. Cs$^+$(g)
3. Li$^+$(g)
4. Cs$^+$(aqueous)

143. In which shell of hydrogen atom, velocity of electron is the highest?
1. 1st shell
2. 2nd shell
3. 3rd shell
4. 4th shell

144. When p-chlorotoluene is reacted with liquid KNH_2 then the major product formed is
1. o-toluidine
2. m-toluidine
3. p-toluidine
4. Toluene

145. The general formula of chain silicate is
1. SiO_4^{4-}
2. $[SiO_3^{2-}]_n$
3. $[Si_2O_5^{2-}]_n$
4. $Si_2O_7^{6-}$

146. When salicylic acid is reacted with phenol in presence of concentrated H_2SO_4, then the product formed is
1. Aspirin
2. Dettol
3. Salol
4. Oil of winter green

147. The monomer units of Nylon-6,10 are
1. Sebacic acid and ethylene glycol
2. Sebacic acid and hexamethylene diammine
3. Adipic acid and ethylene glycol
4. Adipic acid and hexamethylene diammine

148. The rate of diffusion is highest for
1. CH_4
2. SO_2
3. NO_2
4. NH_3

149. In the manufacture of methanol from destructive distillation of wood, pyroligneous acid does not contain
1. Formic acid
2. Acetic acid
3. Methanol
4. Acetone

150. The number of geometrical isomers of
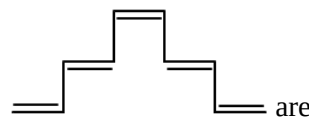
 are
1. 32
2. 20
3. 10
4. 6

Physics - Section A

151. An Atwood's machine with blocks of masses 3 kg and 2 kg is set up in a laboratory. The string is taut and the blocks start moving at $t = 0$.
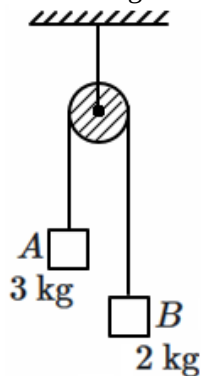
The relative acceleration of the blocks has the magnitude

1. $\frac{g}{5}$
2. $\frac{2g}{5}$
3. $\frac{3g}{5}$
4. $\frac{4g}{5}$

152. The circuit shown in figure is given an input signal V_i, which varies with time and the corresponding output is V_o. Then,
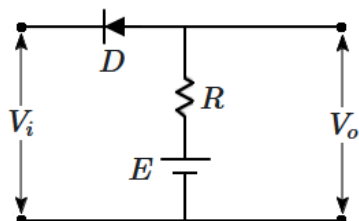
1. $V_o = V_i + E$
2. $V_o = V_i - E$
3. $V_o = V_i$, only when $V_i > E$
4. $V_o = V_i$, only when $V_i < E$

153. A wire, bent into the shape of a right angled triangle PQR, lies with its side PQ parallel to a current carrying wire, and side QR perpendicular to it. The loop lies in the plane of the wire. EMF induced in the loop when it is moved with constant speed along PR is ε_1 and it is ε_2 when moved along QR with the same constant speed. Then,
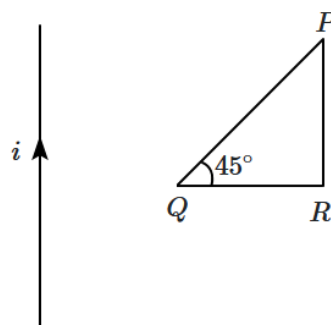
1. $\varepsilon_1 = 0, \varepsilon_2 \neq 0$
2. $\varepsilon_1 \neq 0, \varepsilon_2 = 0$
3. $\varepsilon_1 = 0, \varepsilon_2 = 0$
4. $\varepsilon_1 \neq 0, \varepsilon_2 \neq 0$

154. A block of mass m is placed atop another block of mass M, the combination is at rest on a smooth horizontal table. A force F_1 is applied to m and another force F_2 is applied to M, the two acting horizontally, and in opposite directions. Consider the following statements about the acceleration (a_{cm}) of the centre of mass of the system. (Take right as positive.)
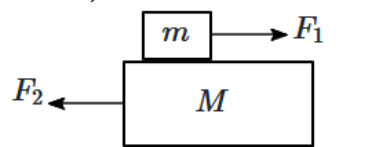
(A) $a_{cm} = \frac{F_1 - F_2}{m+M}$, if there is no friction acting between m and M

(B) $a_{cm} = \frac{F_1 - F_2}{m+M}$, if there is static friction between m and M

(C) $a_{cm} = \frac{F_1 - F_2}{m+M}$, in all situations

1. only A is true.
2. only B is true.
3. C is true.
4. A, B are true but C is false.

155. Ultraviolet photons, each of energy $20\,eV$, are incident onto a gas of H-atoms, causing the emission of electrons. The kinetic energy of the emitted electrons has the value

1. $6.4\,eV$
2. $7.2\,eV$
3. $3.2\,eV$
4. $13.6\,eV$

156. A plane electromagnetic wavefront is incident at an angle of $30°$ onto a flat surface. The difference between the arrival times of the wave at the points A and B is T, where $AB = L$. Then, the speed of the wavefront in the medium is
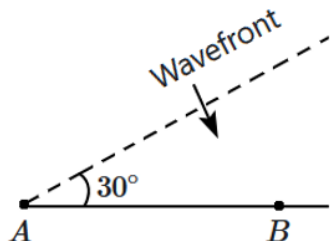

1. $\frac{L}{T}$
2. $\frac{2L}{T}$
3. $\frac{L}{2T}$
4. $\frac{\sqrt{3}L}{T}$

157. Assertion (A): The magnetic moment of a hydrogen like atom is higher when it is in a state of higher quantum number n.
Reason (R): The magnetic moment of hydrogen like atom, as calculated from Bohr's theory, is directly proportional to the principal quantum number n.

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

158. An uncharged spherical conducting shell of outer radius R has two point charges q_1, q_2 placed within it. The flux of the electric field due to all charges from the outer surface of the sphere is Φ_0 while the potential of the sphere is V_0. The ratio $\frac{\Phi_0}{V_0}$ is proportional to
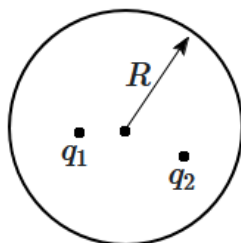
1. $\sqrt{R}$
2. R
3. R^2
4. $\frac{1}{R^2}$

159. A liquid of density ρ flows through a bent tube of cross-section A, with a speed v. The liquid enters at point A and exits at B in the opposite direction. The radius of the bend is R. The tube lies on a horizontal table. The force required to hold the tube equals
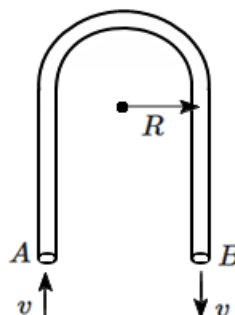
1. $\rho A v^2$
2. $2\rho A v^2$
3. $\sqrt{2}\rho A v^2$
4. $\rho v^2 \pi R^2$

160. A ball of mass m is projected with a speed u, at an angle of θ with the horizontal. At its highest point, it moves on a smooth horizontal platform with a spring of spring constant k attached, and the ball compresses the spring. The maximum compression in the spring is x. Then
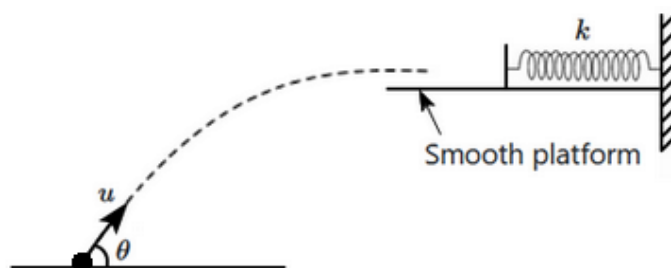
1. $\frac{1}{2}mu^2 = \frac{1}{2}kx^2$
2. $\frac{1}{2}mu^2 cos^2\theta = \frac{1}{2}kx^2$
3. $\frac{1}{2}mu^2 = \frac{1}{2}kx^2 cos^2\theta$
4. $\frac{1}{2}mu^2 sin^2\theta = \frac{1}{2}kx^2$

161. The internal energy of a gas is given by $U = \frac{3}{2}pV$. The gas expands in such a way that its internal energy (initially U_0) remains constant throughout the process, but its volume changes from V_0 to $2V_0$. The heat supplied to the gas equals

1. $U_0 \, ln\,2$
2. $\frac{1}{2}U_0 \, ln\,2$
3. $\frac{1}{3}U_0 \, ln\,2$
4. $\frac{2}{3}U_0 \, ln\,2$

162. The voltage $V_{AB} = 20\,V$ at its peak value, and is sinusoidal in time. The current i (in amperes), when plotted as a function of time, is given by
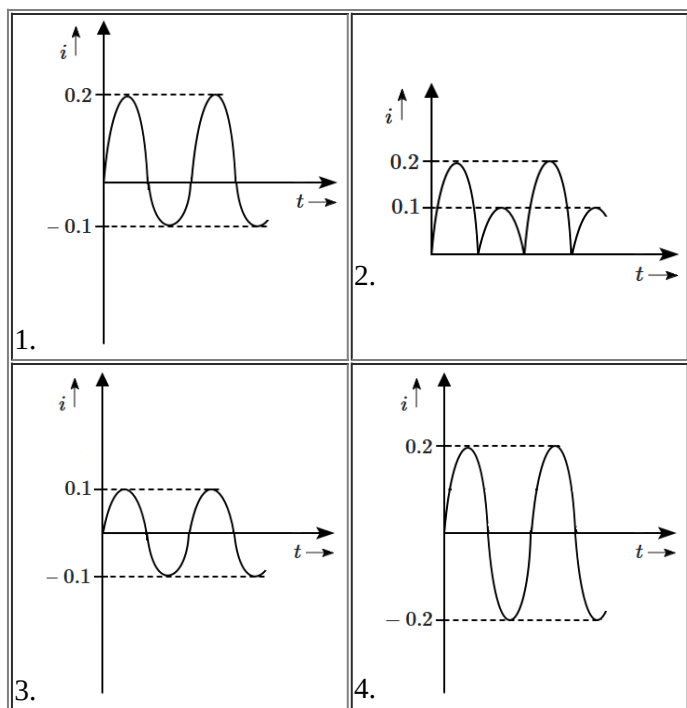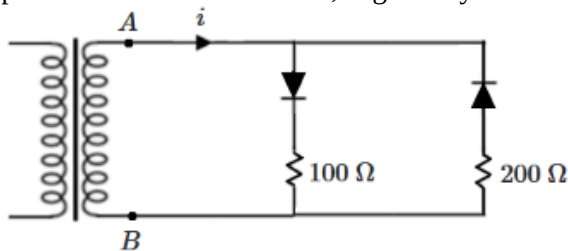

163. Two cars A and B start moving along the same straight road, from the same point, simultaneously. The first car (A) accelerates uniformly to a maximum speed of v_0 and then decelerates uniformly to a stop. The second car (B) accelerates uniformly to the same maximum speed v_0 and then decelerates uniformly to a stop. The acceleration of A is twice that of B, and they both spend the same total time during the motion. Then,

(A) distance travelled by A = distance travelled by B
(B) acceleration time of A = $\frac{1}{2}$ acceleration time of B
(C) relative velocity of A w.r.t. B is always positive
(D) deceleration time of A = $2\times$ deceleration time of B

1. A is true.
2. A, B are true.
3. A, B, C are true.
4. B, C, D are true.

164. The magnetic field at the center O of the semi-circular part of the current-carrying wire, due to the curved and the straight wires (very long), is
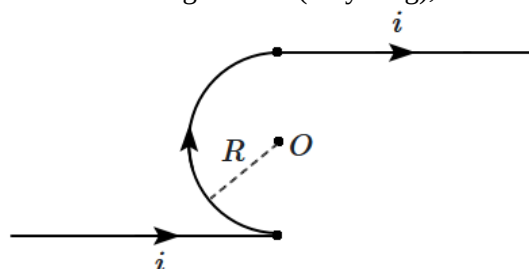
1. $\dfrac{\mu_0 i}{4R}$

2. $\dfrac{\mu_0 i}{4R} + \dfrac{\mu_0 i}{2\pi R}$

3. $\left(\dfrac{\mu_0 i}{4R} + \dfrac{\mu_0 i}{4\pi R} \right)$

4. $\left[\left(\dfrac{\mu_0 i}{4R} \right)^2 + \left(\dfrac{\mu_0 i}{2\pi R} \right)^2 \right]^{1/2}$

165. An Atwood's machine with blocks of masses 3 kg and 2 kg is set up in a laboratory. The string is taut and the blocks start moving at $t = 0$.
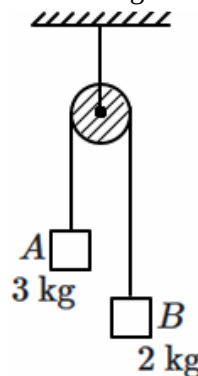
The work done by tension on the 3 kg block has a magnitude W_1 while the work done by gravity on the same block has a magnitude W_2, since the beginning of motion.

1. $W_1 = W_2$
2. $W_1 > W_2$
3. $W_1 < W_2$
4. Any of the above can be true

166. Young's double-slit experiment is conducted with light of wavelength λ. The double-slit is shifted towards the source by a distance L, and the position of the 5th fringe is shifted by
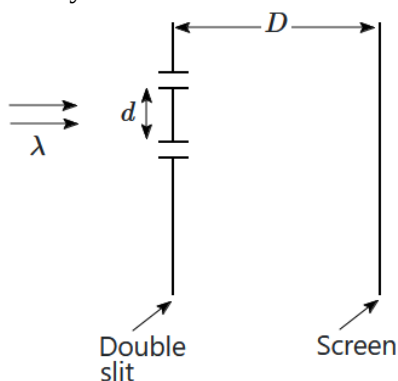
1. $\frac{5\lambda D}{d}$
2. $\frac{5\lambda L}{d}$
3. $\frac{5\lambda (L+D)}{d}$
4. $\frac{5\lambda (L-D)}{d}$

167. When two identical loudspeakers playing the same frequency are placed equidistant from an observer, a sound of 60 dB is heard if the sources are in phase with each other. However, if the two speakers are out of phase, no sound is heard. If the speakers are played with a phase difference of $90°$, the sound heard will be

1. $30\sqrt{2}\ dB$
2. $(60+\sqrt{2})\ dB$
3. $57\ dB$
4. $60\sqrt{2}\ dB$

168. Three stars of identical masses m move around a central star of mass M in an orbit of radius r. The net gravitational force acting on any one of the orbiting stars equals

1. $\frac{GMm}{r^2} + \frac{2Gm^2}{r^2}$
2. $\frac{GMm}{r^2} + \frac{\sqrt{3}Gm^2}{r^2}$
3. $\frac{GMm}{r^2} + \frac{Gm^2}{\sqrt{3}r^2}$
4. $\frac{GMm}{r^2} + \frac{2Gm^2}{\sqrt{3}r^2}$

169. A uniform solid sphere lying on a smooth horizontal surface is acted upon by a horizontal force, which is impulsive and transmits to it a momentum mv, where m is the mass of the sphere (see figure). The angular velocity of the sphere is
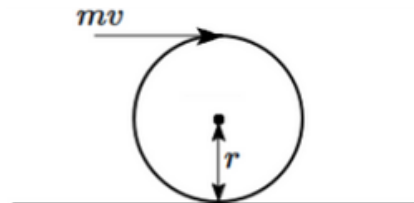
1. $\frac{v}{r}$
2. $\frac{2v}{r}$
3. $\frac{3}{2}\frac{v}{r}$
4. $\frac{5}{2}\frac{v}{r}$

170. A sample of magnetic material is placed in a magnetic field. As the magnetic field is increased, its magnetisation increases and finally, it becomes constant — even if the field is increased further.
Now, the temperature of the sample is decreased. The magnetisation

1. increases
2. decreases
3. remains unchanged
4. decreases first and then increases

171. A point charge q is placed within a spherical cavity inside a metallic conductor, slightly off-center. The charge q induces a charge distribution on the inner surface of the cavity. The net force on q due to the induced charges is
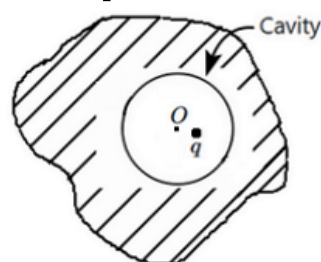
1. zero
2. towards the center
3. away from the center
4. either towards or away from the center depending on the sign of q

172. A vessel containing water is heated from the top by means of a heater, just above the water surface. Assume that the temperature of the water was just above $0°C$, in the beginning. The temperature (θ_A) at the bottom is measured as a function of time. Which, of the following, shows the correct plot?
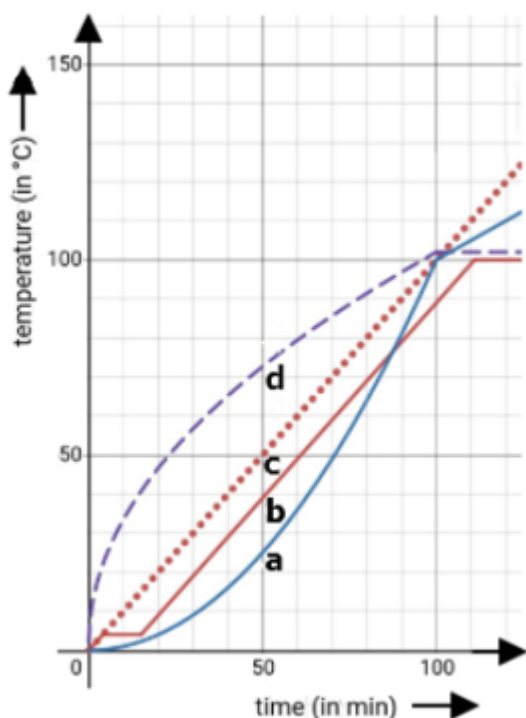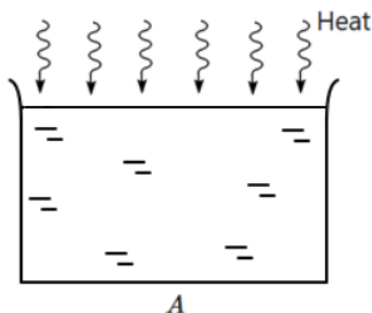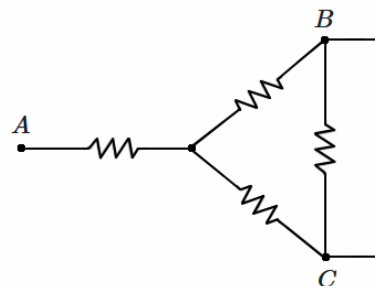

1. a
2. b
3. c
4. d

173. The decay constant (λ) of a radioactive material X is $5 \times 10^{-18}\text{s}^{-1}$. The time in which the activity of a sample of X is reduced to half of its initial value is (nearly)

1. 4.4×10^{11} y
2. 4.4×10^{9} y
3. 8.8×10^{11} y
4. 8.8×10^{9} y

174. All the resistances in the circuit shown below are $2\,\Omega$. The equivalent resistance between A and C is

1. $4\,\Omega$
2. $2\,\Omega$
3. $\frac{4}{3}\,\Omega$
4. $\frac{10}{3}\,\Omega$

175. A parallel beam of width 20 mm is incident onto a lens and the width of the emerging beam decreases at a rate of 1 mm as it travels every 3 cm. The lens has a focal length of

1. 30 cm
2. 60 cm
3. $\frac{20}{3}$ cm
4. $\frac{40}{3}$ cm

176. The quantity η is defined by: $\eta = \frac{1}{\mu_0 \sigma}$ where μ_0 is the permeability of free space and σ is the electrical conductivity (of a plasma). η is referred to as the magnetic diffusivity. Its SI unit is

1. m^2/s
2. m/s^2
3. $\text{C-m}^2/\text{s}$
4. T-m/s

177. The total energy of an electron in the nth orbit of a hydrogen atom is $(-E_n)$. The de-Broglie wavelength of the electron in this orbit is (mass of electron$=m$)

1. $\dfrac{h}{\sqrt{2mE_n}}$
2. $\dfrac{h}{\sqrt{mE_n}}$
3. $\dfrac{h}{\sqrt{4mE_n}}$
4. $\dfrac{hc}{\sqrt{E_n}}$

178. A ray of light, incident at $45°$ onto the surface AB of the right angled prism, is reflected from AC and retraces its path backwards. The refractive index of the material of the prism is
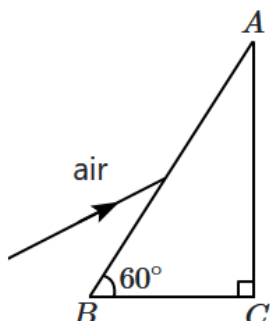

1. $\sqrt{2}$
2. 2
3. $2\sqrt{2}$
4. $2 + \sqrt{2}$

179. The capacitance of the system of three parallel plates of plate area A, plate separation d is measured between the center plate (X) and the two outer plates (Y) connected together. It is equal to
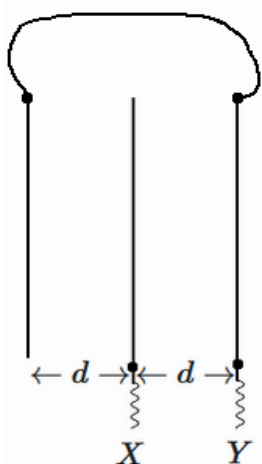
1. $\dfrac{2\varepsilon_0 A}{d}$
2. $\dfrac{\varepsilon_0 A}{2d}$
3. $\dfrac{\varepsilon_0 A}{d}$
4. $\dfrac{4\varepsilon_0 A}{d}$

180. A large cylindrical piece of a dense solid elastic metal stands on its end as shown in the figure. The metal is uniform and isotropic. The stress in the material as a function of height is shown correctly by
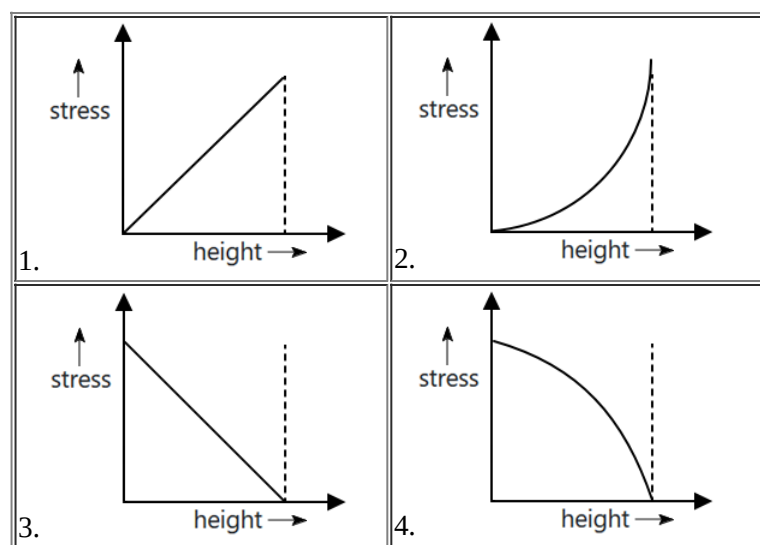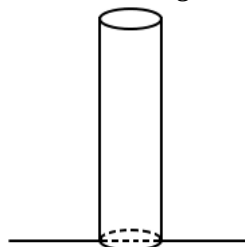
181. In an AC circuit, the power dissipated in a resistance is found to P_1 when a source voltage of V_1 is connected across it. If the same resistance is connected in series with a capacitance and the same source is connected across the combination, the power in the resistance is found to be $P_2 = \dfrac{P_1}{2}$. The phase difference between the voltage and the current is

1. $30°$
2. $60°$
3. $45°$
4. $90°$

182. An equimolar mixture of helium (He) and hydrogen (H_2) gases is kept in a vessel at a temperature of $500\ K$. Then
1. Helium and hydrogen molecules have the same kinetic energy on average.
2. rms speeds of helium and hydrogen molecules are equal.
3. The translational kinetic energy of hydrogen and helium molecules is equal.
4. All of the above are true.

183. A man, swimming with a speed u_1, can cross a river fastest in a time, T. His friend, who swims with a speed u_2, reaches the opposite bank in the same time when he swims at an angle of $30°$ with the bank. Then,

1. $u_1 = \frac{\sqrt{3}}{2} u_2$
2. $u_1 = \frac{1}{2} u_2$
3. $u_1 = \frac{1}{\sqrt{2}} u_2$
4. $u_1 = \frac{1}{\sqrt{3}} u_2$

184. A block of height h and width w is placed on a horizontal table. A horizontal force F is applied parallel to the top surface of the block. The block does not slip due to friction. Let the frictional force on the block be f and the normal reaction of the table on the block be N. Then,
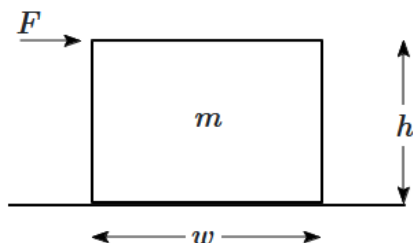
1. N increases as F increases.
2. N does not act through the center of the block.
3. f is greater than F.
4. f acts through the center of the block.

185. An elastic ball is projected vertically upward with a speed u, and it returns to the ground and rebounds, the motion is periodic with a period T. A simple pendulum, having a length equal to maximum altitude attained by this ball, would have a time period of

1. T
2. πT
3. $\pi\sqrt{2}T$
4. $\frac{\pi}{\sqrt{2}}T$

Physics - Section B

186. The average velocity of a projectile from the point of projection to impact is v_1 while the average velocity from projection to maximum height(H) is v_2.
It can be concluded that

1. $v_1 > v_2$
2. $v_1 < v_2$
3. $v_1 = v_2$
4. Any of the above can be true depending on the angle of projection

187. The potential difference V_{AB} (in volts) is plotted as a function of the resistance R. The graph is given by
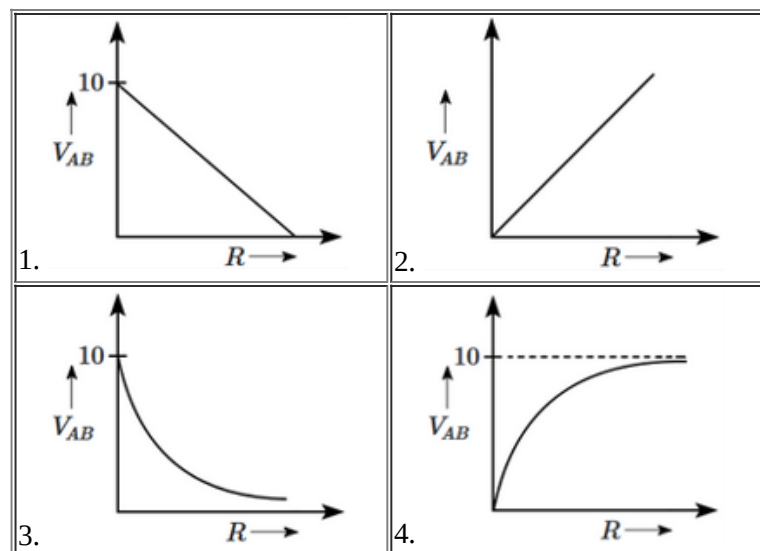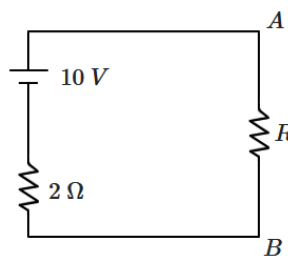
188. A man of mass M throws a ball of mass m vertically upward. At the beginning of the throw, he holds the ball at rest, and releases it at height h above at the end of it. The ball travels up to a maximum height H above the point of release. The work done by the man on the ball is W_1 and that done by gravity on the ball is of magnitude W_2. Both W_1 and W_2 are the work done during the entire motion — from when the man begins the throw, till the ball reaches its maximum height. Then,

1. $\frac{W_1}{W_2} = \frac{m}{M}$
2. $\frac{W_1}{W_2} = \frac{h}{H}$
3. $\frac{W_1}{W_2} = \frac{h}{h+H}$
4. $\frac{W_1}{W_2} = \frac{1}{1}$

189. An input signal to a logic circuit's inputs is represented by a 0, if the voltage is low (true) and by a 1, if the voltage is high (false). The truth table representing the operation of the circuit is given by:

A	B	Y (output)
0	0	0
0	1	1
1	0	0
1	1	0

An input consisting of the following is presented to the pins A and B:
pin A: 0110101001
pin B: 1000011100

The output Y is:

1. 0110100001
2. 1000010100
3. 0111100011
4. 1001010010

190. Four identical point charges (q each) are placed at the four corners of a square of diagonal d. The potential at a point which is at a distance $\frac{d}{2}$ above the center of the square is $\left(k = \frac{1}{4\pi\varepsilon_0} \right)$

1. $\frac{8\,kq}{d}$
2. $\frac{4\,kq}{d}$
3. $\frac{4\sqrt{2}\,kq}{d}$
4. $\frac{\sqrt{2}\,kq}{d}$

191. Three particles of equal mass are connected by massless rods of length L to form an equilateral triangle, ABC. This triangle is pivoted at A and allowed to oscillate in its own plane. The time period of small oscillation is
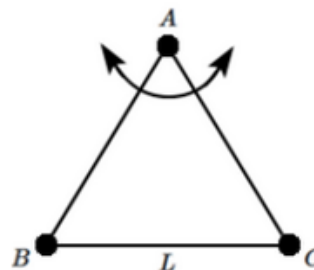
1. $2\pi\sqrt{\frac{L}{g}}$
2. $2\pi\sqrt{\frac{2L}{g}}$
3. $2\pi\sqrt{\frac{L}{2g}}$
4. $2\pi\sqrt{\frac{2L}{\sqrt{3}g}}$

**Hint:** $T = 2\pi\sqrt{\frac{I}{mgd}}$

192. A photon of energy E_p has the same wavelength as an electron of kinetic energy E_e. The rest energy (i.e. mc^2) of the electron is

1. $\frac{E_p^2}{E_e}$
2. $\frac{E_e^2}{E_p}$
3. $\frac{E_e^2}{2E_p}$
4. $\frac{E_p^2}{2E_e}$

193. An ideal gas obeys the law p^2V=constant during a reversible thermodynamic process. The relationship between volume (V) and absolute temperature (T) during this process is:

1. $\frac{V}{T}$=constant
2. $\frac{V^2}{T}$=constant
3. $\frac{T^2}{V}$=constant
4. TV^2=constant

194. A block of mass m slides down the smooth inclined surface of a wedge of mass M starting from rest. The wedge is at rest on the horizontal surface beneath it, due to friction. The acceleration of the center of mass of the system of the block and the wedge is
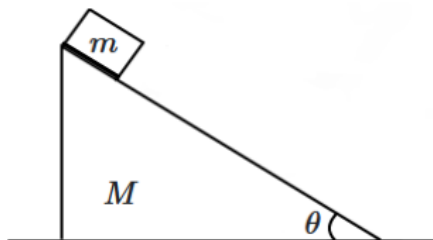

1. $\dfrac{mg\sin\theta}{m+M}$
2. $\dfrac{mg\cos\theta}{m+M}$
3. $g\sin\theta$
4. zero

195. A large vessel of liquid of density ρ is contained in a tank. The tank is pulled towards the right with a constant acceleration a. The upper level of the liquid is not shown in the diagram. Then, the pressures at A and B are related by
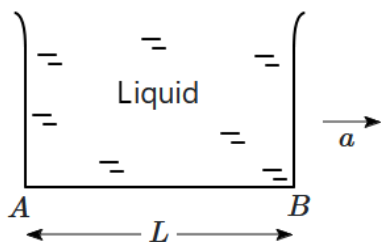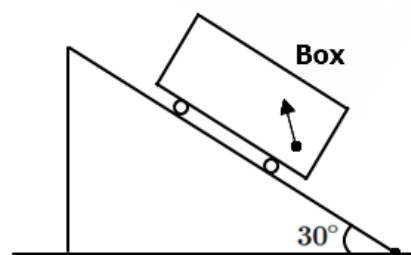

1. $P_A = P_B$
2. $P_A - P_B = L\rho a$
3. $P_B - P_A = L\rho a$
4. $P_A - P_B = L_\rho\sqrt{a^2 + g^2}$

196. The magnitude of the integral of the quantity $\int \vec{B} \cdot \vec{dl}$ around the loop PQR of the equilateral triangle is K. The field at the center of the long solenoid is
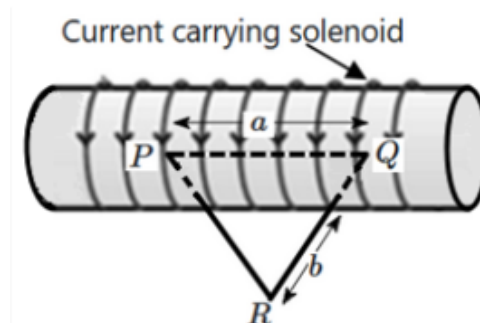
1. $\dfrac{K}{a}$
2. $\dfrac{K}{b}$
3. $\dfrac{K}{a-b}$
4. $\dfrac{K}{a+b}$

197. A box is moving down a frictionless $30°$ incline, and a particle is projected within the box. The acceleration of the particle relative to the box is

1. g
2. $g\sin30°$
3. $g\cos30°$
4. $g\tan30°$

198. A source of sound of frequency 160 Hz, when moving with a speed v towards a fixed identical vibrating source, produces a beat frequency of 10 Hz in the ground frame. The speed of sound in air is 340 m/s. The speed v equals

1. 20 m/s
2. $\dfrac{68}{3}$ m/s
3. $\dfrac{85}{4}$ m/s
4. 25 m/s

199. A convex lens of focal length 60 cm is placed in the path of a parallel beam, falling parallel to its principal axis. A plane mirror is placed on the principal axis, making an angle of $45°$ with it, at a distance of 30 cm behind the lens. The distance of the new focus from lens (optical center) is

1. 60 cm
2. $(60 + 30\sqrt{2})$ cm
3. $60\sqrt{2}$ cm
4. $30\sqrt{2}$ cm

200. In the circuit shown in the adjoining figure, the switch was kept at the position $'1'$ for a long time. The switch K is suddenly (and smoothly) shifted to position $'2'$.
The current through the cell, just after the shift, is
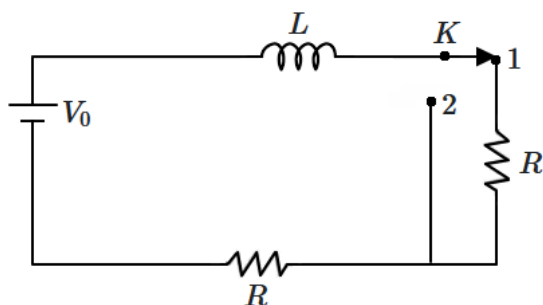
1. $\frac{V_0}{2R}$
2. $\frac{V_0}{R}$
3. $\frac{3V_0}{4R}$
4. zero

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