BIOLOGY

1 Which one of the following matches is correct?

(a)	Phytophthora	Aseptate Mycelium	Basidiomycetes
(b)	*Alternaria*	Sexual reproduction Absent	Deuteromycetes
(c)	*Mucor*	Reproduction by conjugation	Ascomycetes
(d)	*Agaricus*	Parasitic fungus	Basidiomycetes

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

2 Read the following five statements (I to V) and select the option with all correct statements.

I:	Mosses and lichens are the first organisms to colonise bare rock.
II:	*Selaginella* is a homosporous pteridophyte.
III:	Coralloid roots in *Cycas* have VAM.
IV:	Main plant body in bryophytes is gametophytic, whereas in pteridophytes it is sporophytic.
V:	In gymnosperms, male and female gametophytes are present within sporangia located on sporophytes.

1.	**I**, **III** and **IV**	2.	**II**, **III** and **IV**
3.	**I**, **IV** and **V**	4.	**II**, **III** and **V**

3 In which of the following gametophyte is not independent free-living?

1.	*Funaria*	2.	*Marchantia*
3.	*Pteris*	4.	*Pinus*

4 Which one of the following statements is wrong?

1. Algin and carrageenan are products of algae
2. Agar-agar is obtained from *Gelidium* and *Gracilaria*
3. *Chlorella* and *Spirulina* are used as space food
4. Mannitol is stored food in Rhodophyceae

5 The guts of a cow and a buffalo possess:

1. *Fucus* sp
2. *Chlorella* sp
3. methanogens
4. cyanobacteria

6 Male gametes are flagellated in:

1. *Polysiphonia*
2. *Anabaena*
3. *Ectocarpus*
4. *Spirogyra*

7 Vascular bundles in monocotyledons are considered closed because:

1.	a bundle sheath surrounds each bundle
2.	cambium is absent
3.	there are no vessels with perforations
4.	xylem is surrounded all around by phloem

8

is the floral formula of:

1. Allium
2. *Sesbania*
3. *Petunia*
4. Brassica

9 A major characteristic of the monocot root is the presence of:

1.	Scattered vascular bundles
2.	Vasculature without cambium
3.	Cambium sandwiched between phloem and xylem along the radius
4.	Open vascular bundles

10 Keel is the characteristic feature of a flower of:

1. tulip
2. lndigofera
3. *Aloe*
4. tomato

11 Perigynous flowers are found in:

1.	guava	2.	cucumber
3.	China rose	4.	rose

12 Leaves become modified into spines in the:

1. *Opuntia*
2. pea
3. onion
4. silk cotton

13 The structures that are formed by stacking of organised flattened membranous sacks in the chloroplasts are:
1. cristae
2. grana
3. stroma lamellae
4. stroma

14 The chromosomes in which the centromere is situated close to one end are:
1. metacentric
2. acrocentric
3. telocentric
4. sub-metacentric

15 Select the correct matching among the following pairs.
1. Smooth ER-Oxidation of phospholipids
2. Smooth ER-Synthesis of lipids
3. Rough ER-Synthesis of glycogen
4. Rough ER-Oxidation of fatty acids

16 The true nucleus is absent in:
1. *Anabaena*
2. *Mucor*
3. Vaucheria
4. *Volvox*

17 Which one of the following is not an inclusion body found in prokaryotes?

1.	Phosphate granule	2.	Cyanophycean granule
3.	Glycogen granule	4.	Polysome

18 Transpiration and root pressure cause water to rise in plants by:
1. pulling it upward
2. pulling and pushing it, respectively
3. pushing it upward
4. pushing and pulling it, respectively

19 Minerals known to be required in large amounts for plant growth include:
1. phosphorus, potassium, sulphur, calcium
2. calcium, magnesium, manganese, copper
3. potassium, phosphorus, selenium, boron
4. magnesium, sulphur, iron, zinc

20 What causes a green plant exposed to the light on only one side, to bend toward the source of light as it grows?

1.	Green plants need light to perform photosynthesis
2.	Green plants seek light because they are phototropic
3.	Light stimulates plant cells on the lighted side to grow faster
4.	Auxin accumulates on the shaded side, stimulating greater cell elongation there

21 In a ring-girdled plant:
1. the shoot dies first
2. the root dies first
3. the shoot and root die together
4. Neither root nor shoot will die

22 The typical growth curve in plants is:
1. sigmoid
2. linear
3. stair-steps shaped
4. parabolic

23 Which one gives the most valid and recent explanation for stomatal movements?
1. Transpiration
2. Potassium influx and efflux
3. Starch hydrolysis
4. Guard cell photosynthesis

24 The hilum is a scar on the:
1. seed, where the funicle was attached
2. fruit, where it was attached to the pedicel
3. fruit, where style was present
4. seed, where micropyle was present

25 Which one of the following may require pollinators, but is genetically similar to autogamy?

1.	Geitonogamy	2.	Xenogamy
3.	Apogamy	4.	Cleistogamy

26 Which one of the following statements is not true?

1.	Pollen grains are rich in nutrients and they are used in the form of tablets and syrups
2.	Pollen grains of some plants cause severe allergies and bronchial afflictions in some people
3.	The flowers pollinated by flies and beetles secrete foul odour to attract them
4.	Honey is made by bees by digesting pollen collected from flowers

27 Transmission tissue is a characteristic feature of:
1. hollow style
2. solid style
3. dry stigma
4. wet stigma

28 In ginger vegetative propagation occurs through:
1. rhizome
2. offsets
3. bulbils
4. runners

29 Which of the following are the important floral rewards to animal pollinators?
1. Colour and large size of the flower
2. Nectar and pollen grains
3. Floral fragrance and calcium crystals
4. Protein pellicle and stigmatic exudates

30 How many pairs of contrasting characters in pea plants were studied by Mendel in his experiments?

1.	Five	2.	Six
3.	Eight	4.	Seven

31 Which is the most common mechanism of genetic variation in the population of a sexually reproducing organism?
1. Transduction
2. Chromosomal aberrations
3. Genetic drift
4. Recombination

32 A technique of micro-propagation is:
1. somatic hybridization
2. somatic embryogenesis
3. protoplast fusion
4. embryo rescue

33 The movement of a gene from one linkage group to another is called:
1. inversion
2. duplication
3. translocation
4. crossing over

34 Multiple alleles are present:
1. on different chromosomes
2. at different loci on the same chromosome
3. at the same locus of the chromosome
4. on non-sister chromatids

35 Which body of the Government of India regulates GM research and the safety of introducing GM organisms for public services?
1. Bio-safety committee
2. Indian Council of Agricultural Research
3. Genetic Engineering Approval Committee
4. Research Committee on Genetic Manipulation

36 In Bt cotton, the Bt toxin present in plant tissue as pro-toxin is converted into active toxin due to:
1. alkaline pH of the insect gut
2. acidic pH of the insect gut
3. action of gut microorganisms
4. presence of conversion factors in the insect gut

37 The crops engineered for glyphosate are resistant/tolerant to:
1. fungi
2. bacteria
3. insects
4. herbicides

38 DNA is not present in:
1. chloroplast
2. ribosomes
3. nucleus
4. mitochondria

39 Which of the following enhances or induces the fusion of protoplasts?
1. Sodium chloride and potassium chloride
2. Polyethylene glycol and sodium nitrate
3. IAA and kinetin
4. IAA and gibberellins

40 The UN Conference of Parties on climate change in the year 2011 was held in:
1. Poland
2. South Africa
3. Peru
4. Qatar

41 The vertical distribution of different species occupying different levels in a biotic community is known as:
1. divergence
2. stratification
3. zonation
4. pyramid

42 In which of the following do both pairs have the correct combination?

1.	*In situ* conservation/National park *Ex-situ* conservation/Botanical garden
2.	*In situ* conservation/Cryopreservation *Ex-situ* conservation/Wildlife sanctuary
3.	*In situ* conservation/Seed bank *Ex-situ* conservation/ National park
4.	*In situ* conservation/Tissue culture *Ex-situ* conservation/Sacred groves

43 Secondary succession takes place on/in:
1. bare rock
2. degraded forest
3. newly created pond
4. newly cooled lava

44 The mass of living material at a tropic level at a particular time is called:
1. gross primary productivity
2. standing state
3. net primary productivity
4. standing crop

45 In an ecosystem, the rate of production of organic matter during photosynthesis is termed as:
1. net primary productivity
2. gross primary productivity
3. secondary productivity
4. net productivity

46 Which of the following characteristics is mainly responsible for the diversification of insects on land:
1. Segmentation
2. Bilateral symmetry
3. Exoskeleton
4. Eyes

47 Which of the following endoparasites of humans show viviparity?
1. *Ancylostoma* duodenale
2. Enterobius vermicularis
3. Trichinella spiralis
4. *Ascaris* lumbricoides

48 Which of the following represents the correct combination without any exception?

	Characteristic	Class
(a)	Mammary gland; hair on body; pinnae; two pairs of limbs	Mammalia
(b)	Mouth ventral; gills without operculum; skin with placoid scales; persistent notochord	Chondrichthyes
(c)	Sucking and circular mouth; jaws absent; integument without scales; paired appendages	Cyclostomata
(d)	Body covered with feathers; skin moist and glandular; lungs with air sacs; forelimbs from wings	Aves

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

49 Which of the following animals is not viviparous?
1. Flying fox (bat)
2. Elephant
3. Platypus
4. Whale

50 Erythropoiesis starts in:
1. kidney
2. liver
3. spleen
4. red bone marrow

51 The terga,sterna and pleura of the cockroach body are joined by:
1. cementing glue
2. muscular tissue
3. arthrodial membrane
4. cartilage

52 The nuclear envelope is derivative of:
1. smooth endoplasmic reticulum
2. membrane of Golgi complex
3. microtubules
4. rough endoplasmic reticulum

53 Cytochromes are found in:
1. matrix of mitochondria
2. outer wall of mitochondria
3. cristae of mitochondria
4. lysosomes

54 Which one of the following statements is incorrect?

1.	A competitive inhibitor reacts reversibly with the enzyme to form an enzyme inhibitor.
2.	In competitive inhibition, the inhibitor molecule is not chemically changed by the enzyme.
3.	The competitive inhibitor does not affect the rate of breakdown of the enzyme-substrate complex.
4.	The presence of the competitive inhibitor decreases the km of the enzyme for the substrate.

55 Match the following **Column-I** with **Column-II**.

	Column-I		**Column-II**
A.	Synapsis aligns homologous chromosomes	(i)	Anaphase II
B.	Synthesis of RNA and protein	(ii)	Zygotene
C.	Action of enzyme recombinase	(iii)	G_2 - phase
D.	Centromeres do not separate, but chromatids move towards opposite poles	(iv)	Anaphase I
		(v)	Pachytene

1. A-(ii), B-(i), C-(iii), D-(iv)
2. A-(ii), B-(iii), C-(v), D-(iv)
3. A-(i), B-(ii), C-(v), D-(iv)
4. A-(ii), B-(iii), C-(iv), D-(v)

56 A somatic cell that has just completed the S-phase of its cell cycle, as compared to a gamete of the same species has:

1.	twice the number of chromosomes and twice the amount of DNA
2.	the same number of chromosomes but twice the amount of DNA
3.	twice the number of chromosomes and four times the amount of DNA
4.	four times the number of chromosomes and twice the amount of DNA

57 Which of the following statement is not correct?

1.	Brunner's glands are present in the submucosa of stomach and secrete pepsinogen
2.	Goblet cells are present in the mucosa of the intestine and secrete mucus
3.	Oxyntic cells are present in the mucosa of the stomach and secrete HCI
4.	Acini are present in the pancreas and secrete carboxypeptidase

58 The gastric juice of infants contains:

1. maltase, pepsinogen, rennin
2. nuclease, pepsinogen, lipase
3. pepsinogen, lipase, rennin
4. amylase, rennin, pepsinogen

59 When you hold your breath, which of the following gas changes in blood would first lead to the urge to breathe?

1. Falling O_2 concentration
2. Rising CO_2 concentration
3. Falling CO_2 concentration
4. Rising CO_2 and falling O_2 concentration

60 Blood pressure in the mammalian aorta is maximum during:

1. systole of the left atrium
2. diastole of the right ventricle
3. systole of the left ventricle
4. diastole of the right atrium

61 Which one of the following is correct?

1. Serum = Blood + Fibrinogen
2. Lymph = Plasma + RBC + WBC
3. Blood = Plasma + RBC + WBC + Platelets
4. Plasma = Blood – Lymphocytes

62 Removal of the proximal convoluted tubule from the nephron will result in:

1. more diluted urine
2. more concentrated urine
3. no change in the quality and quantity of urine
4. no urine formation

63 Sliding filament theory can be best explained as:

1.	when myofilaments slide past each other, actin filaments shorten while myosin filament does not shorten
2.	actin and myosin filaments shorten and slide past each other
3.	actin and myosin filaments do not shorten but rather slide pass each other
4.	when myofilaments slide past each other, myosin filaments shorten while actin filaments do not shorten

64 Glenoid cavity articulates:

1.	clavicle with acromion	2.	scapula with acromion
3.	clavicle with scapula	4.	humerus with scapula

65 Which of the following regions of the brain is incorrectly paired with its function?

1.	Medulla oblongata-Homeostatic control
2.	Cerebellum-Language comprehension
3.	Corpus callosum-Communication between the left and right cerebral cortices
4.	Cerebrum-Calculation and contemplation

66 A gymnast is able to balance his body upside down even in total darkness because of:
1. cochlea
2. vestibular apparatus
3. tectorial membrane
4. the organ of Corti

67 A chemical signal that has both endocrine and neural roles is:
1. melatonin
2. calcitonin
3. epinephrine
4. cortisol

68 Which of the following does not favour the formation of large quantities of dilute urine?
1. Alcohol
2. Caffeine
3. Renin
4. Atrial-natriuretic factor

69 Capacitation refers to changes in the:
1. sperm before fertilization
2. ovum before fertilization
3. ovum after fertilization
4. sperm after fertilization

70 Which of these is not an important component of the initiation of parturition in humans?
1. Increase in oestrogen and progesterone ratio
2. Synthesis of prostaglandins
3. Release of oxytocin
4. Release of prolactin

71 Which of the following viruses is not transferred through the semen of an infected male?
1. Hepatitis-B virus
2. Human immunodeficiency virus
3. Chikungunya virus
4. Ebola virus

72 Which of the following cells during gametogenesis is normally diploid?
1. Primary polar body
2. Spermatid
3. Spermatogonia
4. Secondary polar body

73 Hysterectomy is the surgical removal of:
1. uterus
2. prostate gland
3. vas deference
4. mammary glands

74 Which of the following is not a sexually transmitted disease?
1. Syphilis
2. Acquired Immuno Deficiency Syndrome (AIDS)
3. Trichomoniasis
4. Encephalitis

75 An abnormal human baby with 'XXX' sex chromosomes was born due to:
1. formation of abnormal ova in the mother
2. fusion of two ova and one sperm
3. fusion of two sperms and one ovum
4. formation of abnormal sperms in the father

76 Alleles are:
1. different phenotype
2. true breeding homozygotes
3. different molecular forms of a gene
4. heterozygotes

77 A man with blood group 'A' marries a woman with blood group 'B'. What are all the possible blood groups of their offspring?
1. A and B
2. A, B and AB
3. A, B, AB and O
4. Only O

78 Gene regulation governing lactose operon of *E. coli* that involves the lac I gene products is:

1.	positive and inducible because it can be induced by lactose.
2.	negative and inducible because repress or protein prevents transcription.
3.	negative and repressible because repress or protein prevents transcription.
4.	feedback inhibition because excess of β galactosidase can switch off transcription.

79 In sea urchin DNA, which is double-stranded 17% of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are:
1. G/34%, A/24.5%, T/24.5%
2. G/17%, A/16.5%, T/32.5%
3. G/17%, A/33%, T/33%
4. G/8.5%, A/50%, T/24.5%

80 Which of the following had the smallest brain capacity?
1. *Homo erectus*
2. *Homo sapiens*
3. Homo neanderthalensis
4. *Homo habilis*

81 A population will not exist in Hardy-Weinberg equilibrium if:
1. individuals mate selectively
2. there are no mutations
3. there is no migration
4. the population is large

82 Match each disease with its correct type of vaccine:

	Column-I		**Column-II**
A.	Tuberculosis	1.	Harmless virus
B.	Whooping cough	2.	Inactivated toxin
C.	Diptheria	3.	Killed bacteria
D.	Polio	4.	Harmless bacteria

1. A-2 B-1 C-3 D-4
2. A-3 B-2 C-4 D-1
3. A-4 B-3 C-2 D-1
4. A-1 B-2 C-4 D-3

83 HIV that causes AIDS first starts destroying:

1.	B-lymphocytes	2.	leucocytes
3.	helper T-lymphocytes	4.	thrombocytes

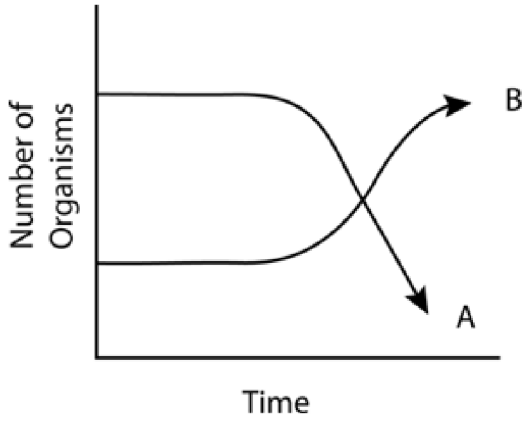
84 The active form of *Entamoeba histolytica* feeds upon:
1. erythrocytes mucosa and submucosa of the colon
2. mucosa and submucosa of colon only
3. food in the intestine
4. blood only

85 A high value of BOD (Biochemical Oxygen Demand) indicates that:

1.	water is pure
2.	water is highly polluted
3.	water is less polluted
4.	consumption of organic matter in the water is higher by the microbes

86 Most animals are tree dwellers in a:
1. coniferous forest
2. thorn woodland
3. temperate deciduous forest
4. tropical rainforest

87 The following graph depicts changes in two populations (A and B) of herbivores in a grassy field. A possible reason for these changes is that:



1.	both plant populations in this habitat decreased
2.	population-B competed more successfully for food than population-A
3.	population-A produced more offspring than population-B
4.	population-A consumed the members of population-B

88 Cryopreservation of gametes of threatened species in viable and fertile conditions can be referred to as:

1.	Advanced ex-situ conservation of biodiversity
2.	In situ conservation by sacred groves
3.	In situ cryo-conservation of biodiversity
4.	In situ conservation of biodiversity

89 Rachel Carson's famous book 'Silent Spring' is related to:
1. pesticide pollution
2. noise pollution
3. population explosion
4. ecosystem management

90 Which of the following is not one of the prime health risks associated with greater UV radiation through the atmosphere due to the depletion of the stratospheric zone?
1. Increased skin cancer
2. Reduced immune system
3. Damage to eyes
4. Increased liver cancer

CHEMISTRY

91 Which of the following species contains an equal number of σ and π bonds?
1. HCO_3^-
2. XeO_4
3. $(CN)_2$
4. $CH_2(CN)_2$

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

93 Which of the following biologically important ions is also a constituent of the sodium pump?
1. Ca^{2+}
2. Mg^{2+}
3. K^+
4. Fe^{2+}

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

I:	Metal nitrates are highly unstable.
II:	Metal nitrates are highly soluble in water.

1. **I** and **II** are True
2. **I** and **II** are False
3. **I** is False but **II** is True
4. **I** is True but **II** is False

95 Solubility of alkaline earth metal sulphates in water decreases in the sequence:
1. Mg > Ca > Sr >Ba
2. Ca > Sr > Ba > Mg
3. Sr > Ca > Mg > Ba
4. Ba > Mg > Sr > Ca

96 A pair among the following have nearly the same atomic radii:
(Numbers in the parenthesis are atomic numbers).
1. Ti (22) and Zr (40)
2. Zr (40) and Nb (41)
3. Zr (40) and Hf (72)
4. Zr (40) and Ta (73)

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

1.	Rusting of iron sheets
2.	Decolourisation of blue $CuSO_4$ solution by iron
3.	Formation of $Fe(CO)_5$ from Fe
4.	Liberation of H_2 from steam by iron at high temperature

98 Which of the following pairs of ions are isoelectronic and isostructural?
1. CO_3^{2-}, SO_3^{2-}
2. ClO_3^-, CO_3^{2-}
3. SO_3^{2-}, NO_3^-
4. ClO_3^-, SO_3^{2-}

99 Which of the following options represents the correct bond order?
1. $O_2^- > O_2 < O_2^+$
2. $O_2^- < O_2 > O_2^+$
3. $O_2^- < O_2 < O_2^+$
4. $O_2^- > O_2 > O_2^+$

100 Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds, but not by the other?
1. Forms acid-rain
2. Is a reducing agent
3. Is soluble in water
4. Is used as a food-preservative

101 Treatment of cyclopentanone with methyl lithium generates:
1. Cyclopentanonyl cation
2. Cyclopentanonyl radical
3. Cyclopentanonyl biradical
4. Cyclopentanonyl anion

102 Choose the compound which has a maximum bond angle at nitrogen among the following:
1. NO_2
2. NO_2^-
3. NO_2^+
4. NO_3^-

103 An ion, among the following, that has a magnetic moment of 2.84 BM is:
(At. no. Ni = 28, Ti = 22, Cr = 24, Co = 27)
1. Ni^{2+}
2. Ti^{3+}
3. Cr^{2+}
4. Co^{2+}

104 Cobalt(III) chloride forms several octahedral complexes with ammonia.
A compound among the following that does not give a test for chloride ions with silver nitrate at 25 °C is:

1.	$CoCl_3.3NH_3$	2.	$CoCl_3.4NH_3$
3.	$CoCl_3.5NH_3$	4.	$CoCl_3.6NH_3$

105 The correct statement, among the following, is:

1.	$[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a low-spin configuration.
2.	$[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a low-spin configuration.
3.	$[Co(CN)_6]^{3-}$ has four unpaired electrons and will be In a high-spin configuration.
4.	$[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a high-spin configuration.

106 The activation energy of a reaction can be determined from the slope of which of the following graphs?
1. ln K vs T
2. ln $\frac{K}{T}$ vs T
3. ln K vs $\frac{I}{T}$
4. ln $\frac{T}{K}$ vs $\frac{I}{T}$

107 For an ideal solution, the non-zero value will be for:
1. ΔH_{mix}
2. ΔS_{mix}
3. ΔV_{mix}
4. $\Delta P = P_{observed} - P_{Raoult}$

108 A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). The molar ratio of the two gases in the mixture will be:

1.	1:4	2.	4:1
3.	16:1	4.	2:1

109 A given metal crystallizes out with a cubic structure having an edge length of 361 pm. If there are four metal atoms in one unit cell, the radius of one atom is:
1. 40 pm
2. 127 pm
3. 80 pm
4. 108 pm

110 When the initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction will be:
1. 0
2. 1
3. 1.5
4. 2

111 The value of the equilibrium constant for a particular reaction is 1.6×10^{12}. When the system is in equilibrium, it will include:
1. All reactants
2. Mostly reactants
3. Mostly products
4. Similar amounts of reactants and products

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

1.	Fuel cell.	2.	Electrolytic cell.
3.	Dynamo.	4.	Ni-Cd cell.

113 The boiling point of 0.2 mol kg^{-1} solution of X in water is greater than the equimolal solution of Y in water. The correct statement in this case is:

1.	X is undergoing dissociation in water.
2.	Molecular mass of X is greater than the molecular mass of Y.
3.	Molecular mass of X is less than the molecular mass of Y.
4.	Y is undergoing dissociation in water while X undergoes no change.

114 The electrolyte having the same value of Van't Hoff factor (i) as that of $Al_2(SO_4)_3$ (if all are 100% ionized) is:
1. K_2SO_4
2. $K_3[Fe(CN)_6]$
3. $Al(NO_3)_3$
4. $K_4[Fe(CN)_6]$

115 The number of d -electrons in Fe^{2+} (atomic number Z = 26) is different from the number of:
1. s-electrons in Mg (Z = 12)
2. p-electrons in Cl (Z = 17)
3. d-electrons in Fe (Z = 26)
4. p-electrons in Ne (Z = 10)

116 The correct order of bond order in the following species is:

1.	$O_2^{2+} > O_2^{+} > O_2^{-}$	2.	$O_2^{2+} < O_2^{-} < O_2^{+}$
3.	$O_2^{+} > O_2^{-} < O_2^{2+}$	4.	$O_2^{-} < O_2^{+} > O_2^{2+}$

117 The angular momentum of electrons in d orbital is equal to:
1. $\sqrt{6}\,\hbar$
2. $\sqrt{2}\hbar$
3. $2\sqrt{3}\,\hbar$
4. $0\ \hbar$

118 The K_{sp} of Ag_2CrO_4, AgCl, AgBr, and AgI are respectively, 1.1×10^{-12}, 1.8×10^{-10}, 5.0×10^{-13}, 8.3×10^{-17}. Which one of the following salts will precipitate last if $AgNO_3$ solution is added to the solution containing equal moles of NaCl, NaBr, NaI, and Na_2CrO_4?
1. AgI
2. AgCl
3. AgBr
4. Ag_2CrO_4

119 Which property of the colloidal solution is independent of charge on the colloidal particles?
1. Coagulation
2. Electrophoresis
3. Electroosmosis
4. Tyndall effect

120 The correct statement for a reversible process in a state of equilibrium is:
1. $\Delta G = -2.30RT \log K$
2. $\Delta G = 2.30RT \log K$
3. $\Delta G^{o} = -2.30RT \log K$
4. $\Delta G^{o} = 2.30RT \log K$

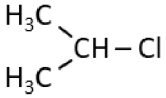
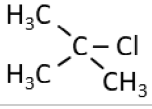
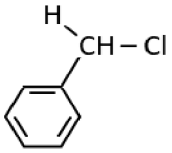
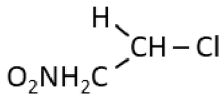
121 Bithional is generally added to the soaps as an additive to function as a/an:
1. softener
2. dryer
3. buffering agent
4. antiseptic

122 What results from the electrolytic reduction of nitrobenzene in a highly acidic medium?
1. p-Aminophenol
2. Azoxybenzene
3. Azobenzene
4. Aniline

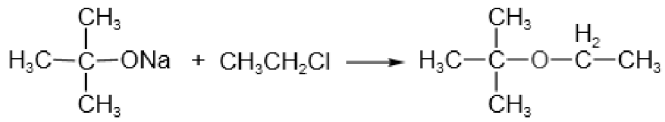
123 In Duma's method for estimation of nitrogen, 0.25 g of an organic compound gave 40 mL of nitrogen collected at 300 K temperature and 725 mm pressure. If the aqueous tension at 300 K is 25 mm, the percentage of nitrogen in the compound is:

1.	17.36	2.	18.20
3.	16.76	4.	15.76

124 In which of the following compounds, the C—Cl bond ionization shall give the most stable carbonium ion?

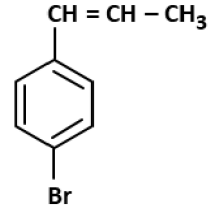
1.		2.	
3.		4.	

125 The reaction,

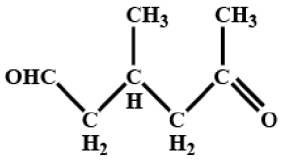


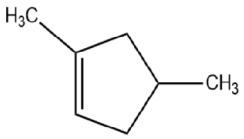
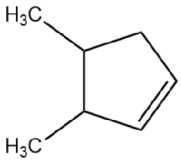
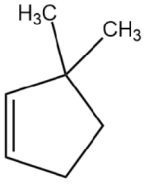
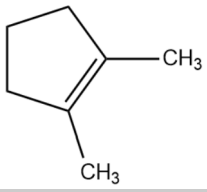
is called:
1. Williamson synthesis
2. Williamson's continuous etherification process
3. Etard reaction
4. Gatterman-Koch reaction

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

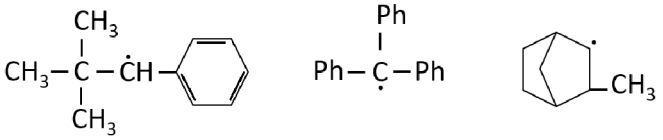
1.	$C_6H_5\underset{\underset{Br}{|}}{C}HCH_2CH_3$
2.	$C_6H_5CH_2\underset{\underset{Br}{|}}{C}HCH_3$
3.	$C_6H_5CH_2CH_2CH_2Br$
4.	

127 When subjected to ozonolysis, which compound results in the formation of the given molecule?



1.		2.	
3.		4.	

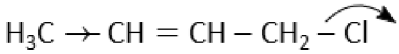
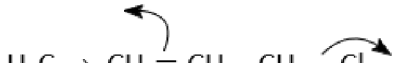
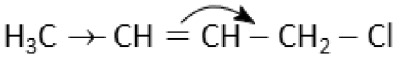
128 Hyperconjugation occurs among the following compounds:



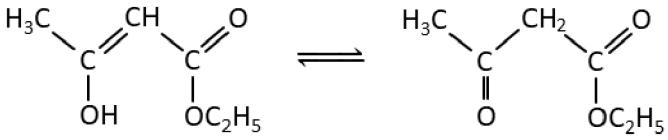
(I) (II) (III)

1.	**I** only	2.	**II** only
3.	**III** only	4.	**I** and **III**

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

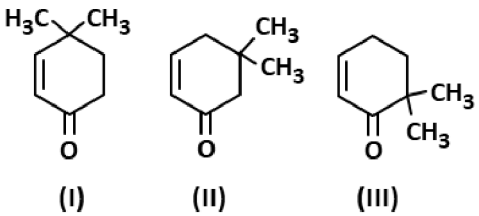
1.	
2.	
3.	
4.	

130 The enolic form of ethyl acetoacetate is given below-



The number of σ and π bonds in the enolic form are respectively:
1. 18 sigma bonds and 2 pi-bonds
2. 16 sigma bonds and 1 pi-bond
3. 9 sigma bonds and 2 pi-bonds
4. 9 sigma bonds and 1 pi-bond

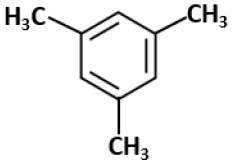
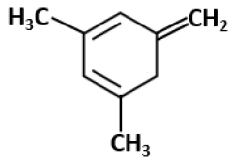
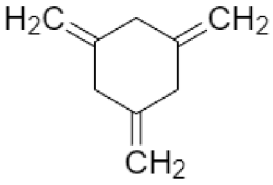
131 Compounds that can exhibit tautomerism, are:



(I) (II) (III)

1. l and ll
2. l and lll
3. ll and lll
4. l, ll and lll

132 Given compounds are as follows:

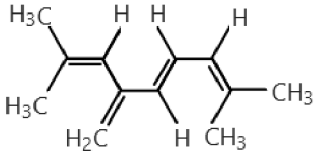
(I)		(II)	
(III)			

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

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

133 A biodegradable polymer that can be prepared from glycine and aminocaproic acid is:
1. Nylon 2-nylon 6
2. PHBV
3. Buna-N
4. Nylon-6,6

134 The total number of pi-bond electrons in the following structure are:



1.	4	2.	8
3.	12	4.	16

135 An organic compound X having molecular formula $C_5H_{10}O$ yields phenyl hydrazone and gives a negative response to the iodoform test and Tollen's test. It produces n-pentane on reduction. X could be:
1. Pentanal
2. 2-Pentanone
3. 3-Pentanone
4. n-Amyl alcohol

PHYSICS

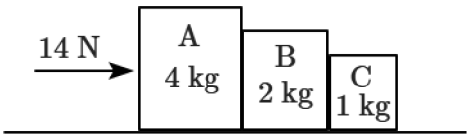
136 If energy (E), velocity (v) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be:
1. $[Ev^{-2}T^{-1}]$
2. $[Ev^{-1}T^{-2}]$
3. $[Ev^{-2}T^{-2}]$
4. $[E^{-2}v^{-1}T^{-3}]$

137 A ship A is moving westward with a speed of 10 kmph and a ship B, 100 km south of A, is moving northward with a speed of 10 kmph. The time after which the distance between them becomes the shortest is:
1. 0 h
2. 5 h
3. $5\sqrt{2}$ h
4. $10\sqrt{2}$ h

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

1.	$-2n\beta^2 x^{-2n-1}$	2.	$-2n\beta^2 x^{-4n-1}$
3.	$-2\beta^2 x^{-2n+1}$	4.	$-2n\beta^2 x^{-4n+1}$

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



1. 2 N
2. 6 N
3. 8 N
4. 18 N

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

1.	$\frac{(m_2+\mu_k m_1)\,g}{(m_1+m_2)}$	2.	$\frac{(m_2-\mu_k m_1)\,g}{(m_1+m_2)}$
3.	$\frac{m_1\,m_2\,(1-\mu_k)\,g}{(m_1+m_2)}$	4.	$\frac{m_1\,m_2\,(1+\mu_k)}{m_1+m_2}g$

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

1.	$W_P = W_Q;\ W_P > W_Q$
2.	$W_P = W_Q;\ W_P = W_Q$
3.	$W_P > W_Q;\ W_P < W_Q$
4.	$W_P < W_Q;\ W_P < W_Q$

142 A block of mass 10 kg, moving in the x-direction with a constant speed of 10 ms^{-1} is subjected to a retarding force $F = 0.1x$ J/m during its travel from $x = 20$ m to 30 m. Its final kinetic energy will be:

1. 475 J
2. 450 J
3. 275 J
4. 250 J

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

1.	$\sqrt{\frac{mk}{2}}t^{-1/2}$	2.	$\sqrt{mk}t^{-1/2}$
3.	$\sqrt{2mk}t^{-1/2}$	4.	$\frac{1}{2}\sqrt{mk}t^{-1/2}$

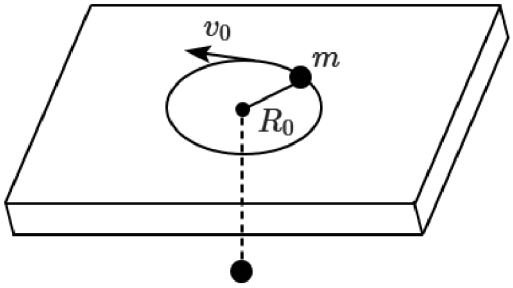
144 Two particles of masses m_1 and m_2 move with initial velocities u_1 and u_2 respectively. On collision, one of the particles gets excited to a higher level, after absorbing energy E. If the final velocities of particles are v_1 and v_2, then we must have:

1.	$m_1^2u_1 + m_2^2u_2 - E = m_1^2v_1 + m_2^2v_2$
2.	$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$
3.	$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 - E = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$
4.	$\frac{1}{2}m_1^2u_1^2 + \frac{1}{2}m_2^2u_2^2 + E = \frac{1}{2}m_1^2v_1^2 + \frac{1}{2}m_2^2v_2^2$

145 A rod of weight w is supported by two parallel knife edges, A and B, and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at a distance x from A. The normal reaction on A is:

1.	$\frac{wx}{d}$	2.	$\frac{wd}{x}$
3.	$\frac{w(d-x)}{x}$	4.	$\frac{w(d-x)}{d}$

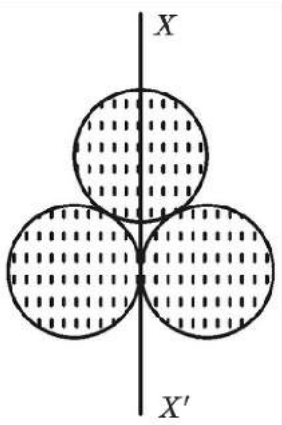
146 A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at a radius R_0. The mass is attached to a string that passes through a smooth hole in the plane, as shown in the figure.



The tension in the string is increased gradually and finally, m moves in a circle of radius $\frac{R_0}{2}$. The final value of the kinetic energy is:

1.	mv_0^2	2.	$\frac{1}{4}mv_0^2$
3.	$2mv_0^2$	4.	$\frac{1}{2}mv_0^2$

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



1.	$\frac{11}{5}mr^2$	2.	$3mr^2$
3.	$\frac{16}{5}mr^2$	4.	$4mr^2$

148 Kepler's third law states that the square of the period of revolution (T) of a planet around the sun, is proportional to the third power of average distance r between the sun and planet i.e. $T^2 = Kr^3$, here K is constant. If the masses of the sun and planet are M and m respectively, then as per Newton's law of gravitation, the force of attraction between them is $F = \frac{GMm}{r^2}$, here G is the gravitational constant. The relation between G and K is described as:

1. $GK = 4\pi^2$
2. $GMK = 4\pi^2$
3. $K = G$
4. $K = \frac{1}{G}$

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

1.	$2.5R$	2.	$4.5R$
3.	$7.5R$	4.	$1.5R$

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

1. $T_P > T_Q > T_R$
2. $T_P > T_R > T_Q$
3. $T_P < T_R < T_Q$
4. $T_P < T_Q < T_R$

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

1. 0.8×10^{-2}
2. 1.0×10^{-2}
3. 1.2×10^{-2}
4. 1.4×10^{-2}

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

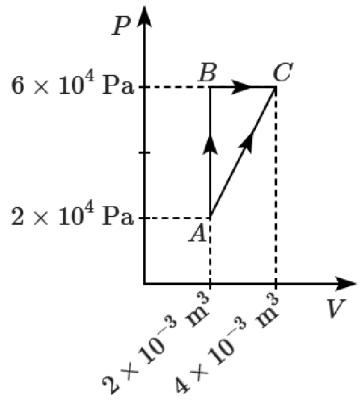
1. 44.0 J/s
2. 16.8 J/s
3. 8.0 J/s
4. 4.0 J/s

153 A wind with a speed of 40 m/s blows parallel to the roof of a house. The area of the roof is 250 m^2. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be:

($\rho_{\text{air}} = 1.2$ kg/m^3)

1. 4×10^5 N, downwards
2. 4×10^5 N, upwards
3. 2.4×10^5 N, upwards
4. 2.4×10^5 N, downwards

154 The figure below shows two paths that may be taken by gas to go from state A to state C.



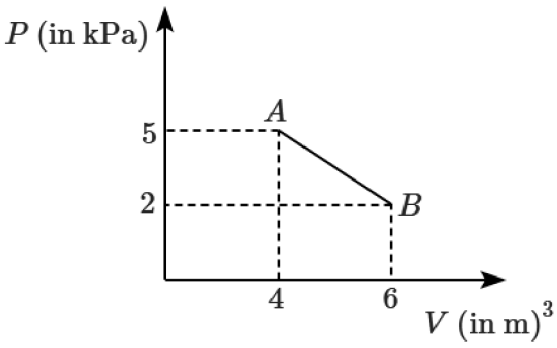
In process AB, 400 J of heat is added to the system, and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be:

1. 380 J
2. 500 J
3. 460 J
4. 300 J

155 A Carnot engine, having an efficiency of $\eta = \frac{1}{10}$ as a heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at a lower temperature is:

1. 100 J
2. 99 J
3. 90 J
4. 1 J

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



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

1.	20 kJ	2.	−20 kJ
3.	20 J	4.	−12 kJ

157 The ratio of the specific heats $\frac{C_P}{C_V} = \gamma$ in terms of degrees of freedom (n) is given by:

1.	$\left(1+\frac{1}{n}\right)$	2.	$\left(1+\frac{n}{3}\right)$
3.	$\left(1+\frac{2}{n}\right)$	4.	$\left(1+\frac{n}{2}\right)$

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

1.	not simple harmonic.
2.	simple harmonic with amplitude $\frac{a}{b}$.
3.	simple harmonic with amplitude $\sqrt{a^2+b^2}$.
4.	simple harmonic with amplitude $\frac{a+b}{2}$.

159 A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 from the mean position are v_1 and v_2, respectively. Its time period is:

1.	$2\pi\sqrt{\frac{x_1^2+x_2^2}{v_1^2+v_2^2}}$	2.	$2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2-v_2^2}}$
3.	$2\pi\sqrt{\frac{v_1^2+v_2^2}{x_1^2+x_2^2}}$	4.	$2\pi\sqrt{\frac{v_1^2-v_2^2}{x_1^2-x_2^2}}$

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

1.	80 cm	2.	100 cm
3.	120 cm	4.	140 cm

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

1.	The potential difference between the plates decreases K times.
2.	The energy stored in the capacitor decreases K times.
3.	The change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$
4.	The charge on the capacitor is not conserved.

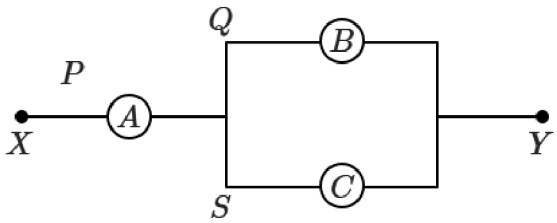
162 The electric field in a certain region is acting radially outward and is given by $E = Aa$. A charge contained in a sphere of radius a centered at the origin of the field will be given by:

1.	$4\pi\varepsilon_o Aa^2$	2.	$\varepsilon_o Aa^2$
3.	$4\pi\varepsilon_o Aa^3$	4.	$\varepsilon_o Aa^3$

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

1. 32 Ω
2. 40 Ω
3. 44 Ω
4. 48 Ω

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

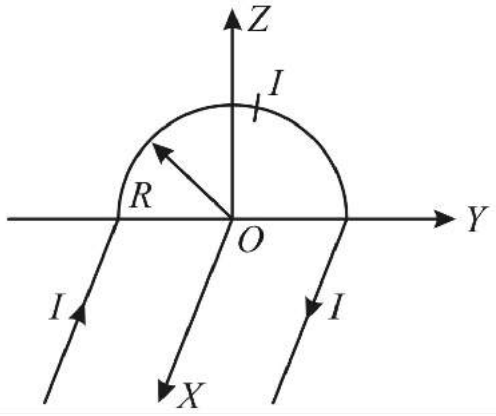


1.	$V_A = V_B = V_C$	2.	$V_A \neq V_B = V_C$
3.	$V_A = V_B \neq V_C$	4.	$V_A \neq V_B \neq V_C$

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

1.	current density	2.	current
3.	drift velocity	4.	electric field

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

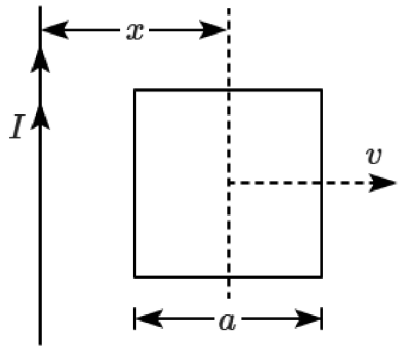


1. $B = \frac{\mu i}{4\pi R}\left(\pi\hat{i} + 2\hat{k}\right)$
2. $B = -\frac{\mu i}{4\pi R}\left(\pi\hat{i} - 2\hat{k}\right)$
3. $B = -\frac{\mu i}{4\pi R}\left(\pi\hat{i} + 2\hat{k}\right)$
4. $B = \frac{\mu i}{4\pi R}\left(\pi\hat{i} - 2\hat{k}\right)$

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

1.	$\frac{\mu_0 ne}{2\pi r}$	2.	zero
3.	$\frac{n^2 e}{r}$	4.	$\frac{\mu_0 ne}{2r}$

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



1.	$\frac{1}{x^2}$	2.	$\frac{1}{(2x-a)^2}$
3.	$\frac{1}{(2x+a)^2}$	4.	$\frac{1}{(2x-a)(2x+a)}$

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

1.	$P\left(\frac{R}{Z}\right)^2$	2.	$P\sqrt{\frac{R}{Z}}$
3.	$P\left(\frac{R}{Z}\right)$	4.	P

170 Radiation of energy E falls normally on a perfectly reflecting surface. The momentum transferred to the surface is:
(c = velocity of light)

1.	$\frac{E}{c}$	2.	$\frac{2E}{c}$
3.	$\frac{2E}{c^2}$	4.	$\frac{E}{c^2}$

171 Two identical thin plano-convex glass lenses (refractive index = 1.5) each having radius of curvature of 20 cm are placed with their convex surfaces in contact at the centre. The intervening space is filled with oil of a refractive index of 1.7. The focal length of the combination is:
1. -20 cm
2. -25 cm
3. -50 cm
4. 50 cm

172 For a parallel beam of monochromatic light of wavelength λ, diffraction is produced by a single slit whose width a is much greater than the wavelength of the light. If D is the distance of the screen from the slit, the width of the central maxima will be:

1.	$\frac{2D\lambda}{a}$	2.	$\frac{D\lambda}{a}$
3.	$\frac{Da}{\lambda}$	4.	$\frac{2Da}{\lambda}$

173 In a double-slit experiment, the two slits are 1 mm apart and the screen is placed 1 m away. Monochromatic light of wavelength 500 nm is used. What will be the width of each slit for obtaining ten maxima of double-slit within the central maxima of a single-slit pattern?
1. 0.2 mm
2. 0.1 mm
3. 0.5 mm
4. 0.02 mm

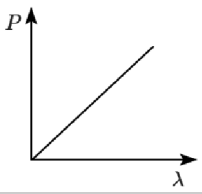
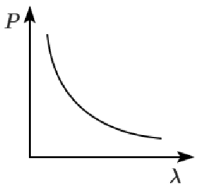
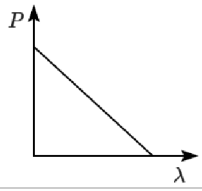
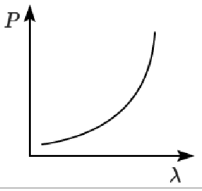
174 The refracting angle of a prism is A, and the refractive index of the material of the prism is $\cot\frac{A}{2}$. The angle of minimum deviation is:

1.	$180^\circ - 3A$	2.	$180^\circ - 2A$
3.	$90^\circ - A$	4.	$180^\circ + 2A$

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

1.	6λ	2.	4λ
3.	$\frac{\lambda}{4}$	4.	$\frac{\lambda}{6}$

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

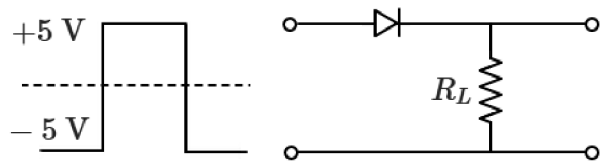
1.		2.	
3.		4.	

177 Consider 3rd orbit of He^+ (Helium). Using a non-relativistic approach, the speed of the electron in this orbit will be: (given $Z = 2$ and h (Planck's constant)$= 6.6 \times 10^{-34}$ J-s)
1. 2.92×10^6 m/s
2. 1.46×10^6 m/s
3. 0.73×10^6 m/s
4. 3.0×10^8 m/s

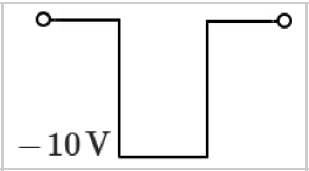
178 If the radius of $^{27}_{13}\text{Al}$ nucleus is taken to be R_{Al}, then the radius of $^{125}_{53}\text{Te}$ nucleus is near:

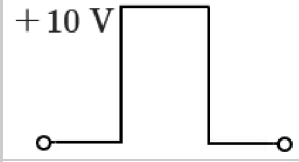
1.	$\left(\frac{53}{13}\right)^{\frac{1}{3}} R_{Al}$	2.	$\frac{5}{3} R_{Al}$
3.	$\frac{3}{5} R_{Al}$	4.	$\left(\frac{13}{53}\right) R_{Al}$

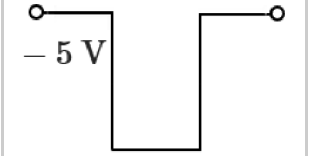
179 If in a p-n junction, a square input signal of 10 V is applied as shown,

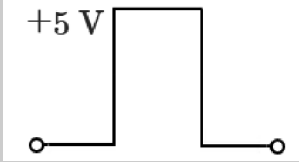


then the output across R_L will be:

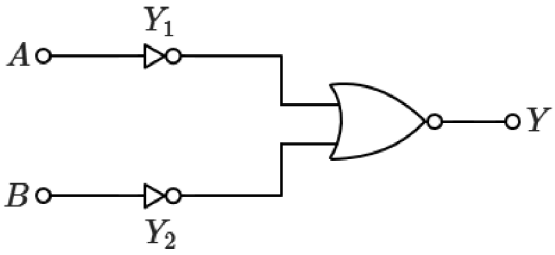
1. 

2. 

3. 

4. 

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



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