

SAMPLE PAPER - 121

Time : 1 : 15 Hr.

Question : 60

PHYSICS

01. The radius of gyration of a uniform rod of length L , about an axis passing through a point $\frac{L}{4}$ away from the centre of the rod, and perpendicular to it, is

(1) $\sqrt{\frac{7}{48}}L$ (2) $\sqrt{\frac{5}{48}}L$ (3) $\sqrt{\frac{7}{24}}L$ (4) $\sqrt{\frac{19}{24}}L$

02. A particle A has charge $+q$ and a particle B has charge $+4q$ with each of them having the same mass m . When allowed to fall from rest through the same electric potential

difference, the ratio of their speed $\frac{v_A}{v_B}$ will become

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

03. The energy supplied by battery to charge a parallel plate condenser of plate separation d and plate area of cross-section A , such that the uniform electric field between the plates is

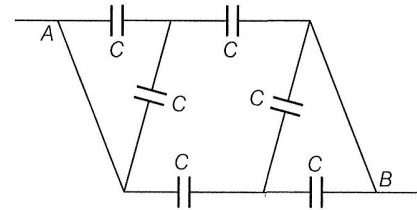
(1) $\epsilon_0 E^2 Ad$ (2) $\frac{1}{2} \epsilon_0 E^2 Ad$

(3) $\frac{1}{2} \epsilon_0 E^2 / Ad$ (4) $\epsilon_0 E^2 / Ad$

04. Two charged spheres of radii R_1 & R_2 have equal surface charge density. The ratio of their potential is

(1) R_1/R_2 (2) R_2/R_1
 (3) $(R_1/R_2)^2$ (4) $(R_2/R_1)^2$

05. A network of six identical capacitors, each of value C , is made as shown in the figure. Equivalent capacitance between points A and B is

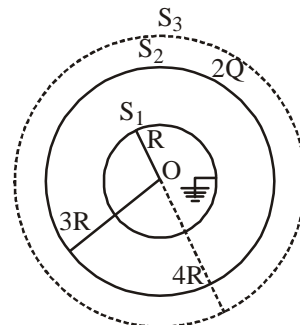


(1) $C/4$ (2) $3C/4$
 (3) $4C/3$ (4) $3C$

06. A capacitor of capacity C is charged with a battery of emf V and disconnected. The distance between its plates is reduced to one third. Then, to charge the capacitor upto the potential V the battery is connected again, the energy given by the battery after reconnection will be

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

07. In the given diagram, two concentric conducting spherical shells S_1 and S_2 are shown. Charge on S_2 is $2Q$, while S_1 is earthed. Find electric flux passing through surface S_3 .



(1) $\frac{1Q}{3\epsilon_0}$ (2) $\frac{4Q}{3\epsilon_0}$ (3) $\frac{2Q}{\epsilon_0}$ (4) Zero

08. A thermometer graduated according to a linear scale reads a value x_0 when in contact with boiling water, and $x_0/3$ when in contact with ice. What is the temperature of an object in $^{\circ}C$, if this thermometer in contact with the object reads $x_0/2$?

(1) 35 (2) 25 (3) 60 (4) 40

09. A cylinder of radius R is surrounded by a cylindrical shell of inner radius R and outer radius $2R$. The thermal conductivity of the material of the inner cylinder is K_1 and that of the outer cylinder is K_2 . Assuming no loss of heat, the effective thermal conductivity of the system for heat flowing along the length of the cylinder is :

- (1) $K_1 + K_2$ (2) $\frac{K_1 + K_2}{2}$
 (3) $\frac{2K_1 + 3K_2}{5}$ (4) $\frac{K_1 + 3K_2}{4}$

10. A cup of coffee cools from 90°C to 80°C in t minutes, when the room temperature is 20°C . The time taken by a similar cup of coffee to cool from 80°C to 60°C at a room temperature same at 20°C is

- (1) $\frac{5}{13}t$ (2) $\frac{13}{10}t$ (3) $\frac{13}{5}t$ (4) $\frac{10}{13}t$

11. Two monoatomic ideal gas at temperature T_1 and T_2 are mixed. There is no loss of energy. If the masses of molecules of the two gases are m_1 and m_2 and number of their molecules are n_1 and n_2 respectively. The temperature of the mixture will be :

- (1) $\frac{T_1 + T_2}{n_1 + n_2}$ (2) $\frac{T_1}{n_1} + \frac{T_2}{n_2}$
 (3) $\frac{n_2 T_1 + n_1 T_2}{n_1 + n_2}$ (4) $\frac{n_1 T_1 + n_2 T_2}{n_1 + n_2}$

12. The total kinetic energy of 1 mole of N_2 at 27°C will be approximately :

- (1) 1500 J (2) 1500 Calories
 (3) 1500 kilo Calories (4) 1500 erg.

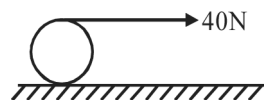
13. The root mean square velocity of a gas molecule of mass m at a given temperature is proportional to -

- (1) m° (2) m (3) \sqrt{m} (4) $\frac{1}{\sqrt{m}}$

14. A body of mass ($4m$) is lying in x - y plane at rest. It suddenly explodes into three pieces. Two pieces each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is

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

15. A string is wound around a hollow cylinder of mass 5 kg and radius 0.5 m. If the string is now pulled with a horizontal force of 40 N, and the cylinder is rolling without slipping on a horizontal surface (see figure), then the angular acceleration of the cylinder will be (Neglect the mass and thickness of the string)

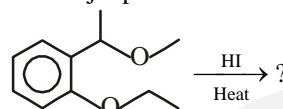


- (1) 12 rad/s^2 (2) 16 rad/s^2
 (3) 10 rad/s^2 (4) 20 rad/s^2

CHEMISTRY

16. A fruity smell is obtained by the reaction of ethanol with:
 (1) CH_3COCH_3 (2) PCl_5
 (3) CH_3COOH (4) CH_3CHO

17. The major product formed in the following reaction is:



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

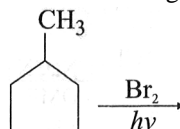
18. The heating of phenyl methyl ether with HI produces :
 (1) benzene (2) ethylchloride
 (3) iodobenzene (4) phenol

19. $\text{H}_3\text{C}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}=\text{CH}_2 + \text{HBr} \longrightarrow (A)$,

(A) predominantly is:

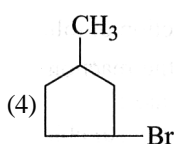
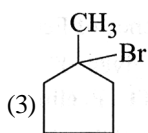
- (1) $\text{CH}_3-\text{CH}_2-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2\text{Br}$
 (2) $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\underset{\text{Br}}{\text{CH}}-\text{CH}_3$
 (3) $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\underset{\text{Br}}{\text{CH}}-\text{CH}_2\text{CH}_2\text{Br}$
 (4) $\text{CH}_3-\underset{\text{CH}_3}{\text{C}}(\text{Br})-\text{CH}_2\text{CH}_3$

20. In the following reaction,



The major product obtained is :

- (1) (2)



21. In an iodometric estimation, the following reactions occur
 $2\text{Cu}^{2+} + 4\text{I}^- \rightarrow \text{Cu}_2\text{I}_2 + \text{I}_2$
 $\text{I}_2 + 2\text{Na}_2\text{S}_2\text{O}_3 \rightarrow 2\text{NaI} + \text{Na}_2\text{S}_4\text{O}_6$
 0.12 mole of CuSO_4 was added to excess of KI solution and the liberated iodine required 120 mL of hypo. The molarity of hypo solution was

(1) 2 (2) 0.20 (3) 0.1 (4) None

22. Two moles of NH_3 when put into a previously evacuated vessel (one litre), partially dissociated into N_2 and H_2 . If at equilibrium one mole of NH_3 is present, the equilibrium constant is

(1) $3/4 \text{ mol}^2\text{litre}^{-2}$ (2) $27/64 \text{ mol}^2\text{litre}^{-2}$
 (3) $27/32 \text{ mol}^2\text{litre}^{-2}$ (4) $27/16 \text{ mol}^2\text{litre}^{-2}$

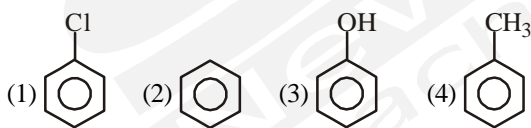
23. A 20 L container at 400 K contains $\text{CO}_2(\text{g})$ at pressure 0.8 atm and excess of SrO (neglect the volume of solid SrO). The volume of the container is not decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be (Given that : $\text{SrCO}_3(\text{s}) \rightleftharpoons \text{SrO}(\text{s}) + \text{CO}_2(\text{g})$, $K_p = 1.6 \text{ atm}$)

(1) 10 L (2) 4 L (3) 2 L (4) None

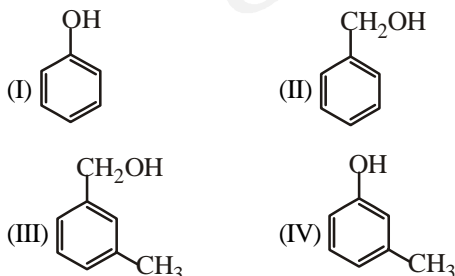
24. A 3.4 g sample of H_2O_2 solution containing x% H_2O_2 by mass requires x mL of a KMnO_4 solution for complete oxidation under acidic condition. The molarity of KMnO_4 solution is

(1) 1 (2) 0.5 (3) 0.4 (4) 0.2

25. Which of the following will be most easily attacked by an electrophilic?



26. Which of the following compounds is aromatic alcohol?



(1) I, II, III, IV
 (3) II, III

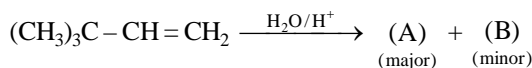
(2) I, IV
 (4) I

27. Which of the following is most acidic?
 (1) Benzyl alcohol (2) Cyclohexanol
 (3) Phenol (4) m-Chlorophenol

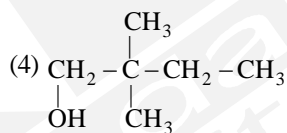
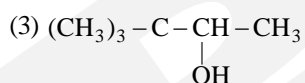
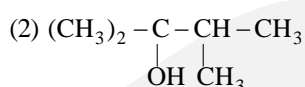
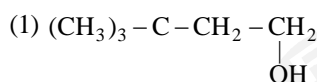
28. A compound 'X' undergoes reduction with LiAlH_4 to yield 'Y'. When vapours of 'Y' are passed over freshly reduced copper at 300°C , 'X' is formed. What is 'Y'?

(1) CH_3COCH_3 (2) CH_3CHO
 (3) $\text{CH}_3\text{CH}_2\text{OH}$ (4) $\text{CH}_3-\text{O}-\text{CH}_3$

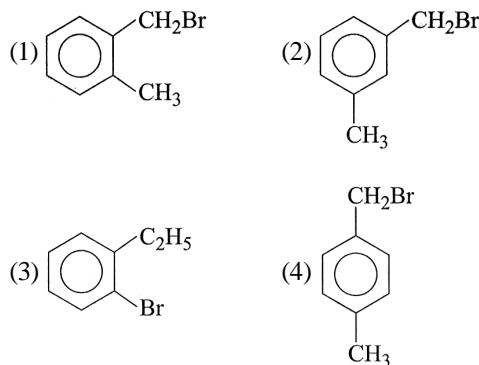
29. In the following reaction,



the major product (A) is:



30. Compound (A), $\text{C}_8\text{H}_9\text{Br}$ gives a white precipitate when warmed with alcoholic AgNO_3 . Oxidation of (A) gives an acid (B), $\text{C}_8\text{H}_6\text{O}_4$. (B) easily forms anhydride on heating. Identify the compound (A)?



BOTANY

31. In roots, absorption of water and minerals mostly occurs in the:

(1) Root cap
 (2) Region of elongation
 (3) Region of maturation
 (4) Meristematic region

32. Lateral branches with short internodes giving rise to roots below and leaves above at nodes are observed in:
 (1) Pea, Citrus
 (2) Chrysanthemum, Banana
 (3) Mustard, Salvia
 (4) Eichhornia, Pistia
33. Indigo dye is obtained from an angiosperm plant Indigofera. Which set of angiospermic plants belong to same angiospermic family to which Indigofera belongs?
 (1) Soyabean, Sesbania
 (2) Belladonna, Sunhemp
 (3) Muliathi, Aloe
 (4) Sunflower, Trifolium
34. Mendel's law of segregation states that:
 (1) The alleles do not show any blending and that both the characters are recovered as such in F_2 generation
 (2) The factors or alleles of a pair segregate from each other such that a gamete receives only one of the two factors
 (3) Homozygous parent produces all gametes that are similar while heterozygous produces two kinds of gametes each having one allele with equal proportion
 (4) All of the above
35. Which of the following statements is not true?
 (1) Two organisms with the same genotype must have different phenotypes
 (2) Two organisms with the same phenotype have different genotypes
 (3) A heterozygous organism has the same phenotype as a homozygous organism
 (4) A heterozygous organism has the same number of alleles for a given gene as a homozygous organism
36. In a dihybrid cross between AABB and aabb, the ratio of AABB, AABb, aaBb, aabb in F_2 generation is:
 (1) 9 : 3 : 3 : 1 (2) 1 : 1 : 1 : 1
 (3) 1 : 2 : 2 : 1 (4) 1 : 1 : 2 : 2
37. Which one of the following cannot be explained on the basis of Mendel's Law of Dominance?
 (1) Out of one pair of factors one is dominant and the other recessive
 (2) Alleles do not show any blending and both the characters recover as such in F_2 generation
 (3) Factors occur in pairs
 (4) The discrete unit controlling a particular character is called a factor
38. A dihybrid plant on self-pollination, produced 400 phenotypes with 4 types of genotype. How many seeds will have genotype TtRr?
 (1) 200 (2) 100
 (3) 50 (4) 150
39. How many below given statement(s) are not true regarding Mendel experiment?
 (i) Mendel selected 14 true-breeding pea plant varieties, as pairs which were similar except for one character with contrasting traits.
 (ii) Only one of the parental traits was expressed in the F_2 generation.
 (iii) In F_1 stage of monohybrid cross both the parental traits were expressed in the proportion 3:1.
 (iv) The contrasting traits did not show any blending at either F_1 or F_2 stage.
 (v) Factors stably passed down, unchanged, from parent to offspring through the gametes, over successive generations.
 (vi) Mendelian factors are genes, which contain the information that is required to express a particular trait in an organism.
 (1) One
 (2) Two
 (3) Three
 (4) None of these
40. In Mendel's experiments with garden pea, round seed shape (RR) was dominant over wrinkled seeds (rr), yellow cotyledon (YY) was dominant over green cotyledon (yy), what are the expected number of plant with genotype RrYY in the F_2 generation of the cross RRYy \times rryy?
 (1) two (2) four
 (3) two out of sixteen (4) four out of sixteen
41. Read the following statements carefully.
 A. Leaf base may bear two lateral small leaf like structures called stipules.
 B. In dicots, the leaf base expands into a sheath covering the stem partially or wholly.
 C. Veins provide rigidity to the leaf blade.
 D. In monocots, leaf base is swollen and is known as pulvinus.
 E. The petiole holds the blade to light.
 How many statement (s) is/are incorrect?
 (1) Two (2) Three (3) Five (4) One
42. Read the following statements.
 A. The main axis terminates into a flower in the inflorescences of Solanum
 B. Leaves can be modified to tendrils and spines for protection and climbing respectively
 (1) Both A & B are correct
 (2) Only B is incorrect
 (3) Both A & B are incorrect
 (4) Only A is incorrect
43. How many of the following are incorrect?
 A. Floral formula shows cohesion and adhesion within parts of whorls and between whorls.
 B. Solanaceae is widely distributed in tropics, subtropics, and even temperate zones.
 C. Many plants belonging to family Liliaceae are good ornamentals, source of medicine, vegetables and colchicine.

D. Generally dicotyledonous plants have tap roots while monocotyledonous plants have fibrous roots.

E. In banana, pineapple, Pistia and Chrysanthemum, the lateral branches originate from the basal and underground portion of the main stem, grow horizontally beneath the soil, and then come out obliquely upward given rise to leafy shoots.

F. Photosynthesis is restricted to tendrils in Opuntia and peas.

- (1) 0 (2) 1 (3) 2 (4) 3

44. How many plants among Indigofera, Sesbania, Salvia, Allium, Aloe, mustard, groundnut, radish, gram and turnip have stamens with different lengths in their flowers?
(1) Five (2) Six (3) Three (4) Four
45. Select the option with incorrect information about the given angiospermic families:
(1) Fabaceae family : Polypetalous condition : Diadelphous
(2) Fabaceae family : Zygomorphic flowers : Racemose
(3) Solanaceae family : Cymose inflorescence : Actinomorphic
(4) Liliaceae family : 5 stamens, monadelphous : Axile placentation

ZOOLOGY

46. Which of the following antibiotic resistance genes are used as selectable marker for E. coli?
(1) Chloramphenicol (2) Tetracycline
(3) Kanamycin (4) All of these
47. When restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites between the same two bases of opposite strands, it produces
(1) Sticky end
(2) Blunt end
(3) Flush end
(4) Non-cohesive end
48. The formulation with suitable preservatives in the case of drugs has to undergo
(1) Through clinical trials
(2) Through strict separation techniques
(3) Through harsh heat shock control
(4) Through long restriction digestion
49. To make bacterium competent (Transformation with recombinant DNA) we use
(1) Specific concentration of Ca^{2+} ion
(2) Heat shock ($42^{\circ}C$)
(3) Both (1) and (2)
(4) None of these

50. Restriction enzymes of E.coli are
(1) HindIII (2) BamHI
(3) EcoRI, EcoRII (4) All of these
51. The piece of equipment, that introduces DNA into cells via DNA-coated microprojectiles is known as
(1) Laser
(2) DNA probe
(3) Gene gun
(4) Inoculating needle
52. Key tools to be involved in recombinant DNA technology are
A. Restriction enzymes
B. Host
C. Polymerase
D. Vectors
(1) A only (2) A and C
(3) A, B, C and D (4) C and D
53. Infection of Entamoeba histolytica can not be prevented by:
(1) Control of mosquito
(2) Covering the food articles
(3) Washing hands before taking meals
(4) Washing the vegetables before their consumption
54. A person is suffering from insomnia. It means he is suffering from:
(1) Excessive sleep disorder and needs opioids
(2) Lack of sleep and needs barbiturates
(3) Depression and needs amphetamines
(4) Lack of sleep and needs alcohol
55. Sarcoma is related to the cancer of:
(1) Connective and muscular tissue
(2) Epithelial tissue
(3) Brain
(4) Breast
56. Gel electrophoresis is a
(1) Technique of separation of charged molecules under the influence of magnetic field
(2) Technique of incorporation of DNA molecules into the cell through transient pores made due to electrical impulses
(3) Technique of separation of DNA fragments through the pores of agarose gel under the influence of electric field
(4) Technique of separation and purification of gene products
57. In 1963, two enzymes were discovered in bacteria that were responsible for providing immunity against bacteriophages. One was Restriction Endonuclease and the other was
(1) Methylase (2) Exonuclease
(3) Aminotransferase (4) Terminal Transferase

58. Significance of the 'heat shock' method in bacterial transformation is to facilitate
- (1) Binding of DNA to the cell wall.
 - (2) Uptake of DNA through membrane transport proteins.
 - (3) Uptake of DNA through transient pores in the bacterial cell wall.
 - (4) Expression of antibiotic resistance gene.

59. Based on the nomenclature of the molecular scissors, match the columns and choose the correct option.

Column-I		Column-II	
A.	co	(i)	Species
B.	I	(ii)	Genus
C.	R	(iii)	Strain
D.	E	(iv)	Order of extraction

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

60. Find the true statement.

- (1) Ori means origin of transcription.
- (2) Vector should have single recognition sites for commonly used restriction enzymes so that alien DNA can attach to that sites easily
- (3) Vector should have many recognition sites for commonly used restriction enzymes so that alien DNA can attach to any one of the sites easily.
- (4) TetR gene in pBR322 can be cleaved by PvuI and PstI.

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