Kerala Medical Entrance Examination 2006
Chemistry and Physics

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1. The paramagnetism of O_2^+ is due to the presence of an odd electron in the MO

   (A) σ^*_{2s} (B) $\pi\, 2p_y$ (C) $\pi\, 2p_z$ (D) $\sigma^*\, 2p_x$ (E) $\pi^*\, 2p_y$

2. If at certain temperature the vapour pressure of pure water is 25 mm Hg and that of a very dilute aqueous urea solution is 24.5 mm Hg, the molality of the solution is

   (A) 0.02 (B) 1.2 (C) 1.11 (D) 0.08 (E) 0.06

3. If the equilibrium constant for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at 750 K is 49, then the equilibrium constant for the reaction

   $$NH_3(g) \rightleftharpoons \frac{1}{2} N_2(g) + \frac{3}{2} H_2(g)$$ at the same temperature is

   (A) $\frac{1}{49}$ (B) 49 (C) 7 (D) 49^2 (E)

4. The correct relation between equilibrium constant (K), standard free energy ($\Delta G°$) and temperature (T) is

   (A) $\Delta G° = RT \ln K$ (B) $K = e^{-\Delta G°/2.303RT}$

   (C) $\Delta G° = -RT \log_{10} K$ (D) $K = 10^{-\Delta G°/2.303RT}$ (E) $\Delta G° = R \ln K$

5. Which among the following is the heaviest?

   (A) One mole of oxygen (B) One molecule of sulphur trioxide

   (C) 100 amu of uranium (D) Ten moles of hydrogen

   (E) 44 g of carbon dioxide

6. Arrange the following ions in the order of their magnetic moment

(a) V^{4+} (b) Mn^{4+} (c) Fe^{3+} (d) Ni^{2+}

(Atomic No. of V = 23, Mn = 25, Fe = 26, Ni = 28)

(A) (b) > (c) > (a) > (d) (B) (c) > (d) > (b) > (a)

(C) (c) > (b) > (d) > (a) (D) (a) < (d) < (c) < (b) (E) (d) < (c) < (a) < (b)

7. Which one of the following electrolytes would dissolve in water to give a 0.1M solution with pH about 9?

(A) CH_3COOH (B) CH_3COONa

(C) NH_4Cl (D) KOH (E) NaCl

8. Match the lists I and II and write the correct matching

	List I Species		List II Geometry
a.	H_3O^+	1.	Planar
b.	$H_2C{=}NH$	2.	Angular
c.	ClO_2^-	3.	Tetrahedral
d.	NH_4^+	4.	Trigonal bipyramidal
e.	PCl_5	5.	Pyramidal

(A) a – 2, b – 1, c – 3, d – 5, e – 4 (B) a – 1, b – 5, c – 2, d – 3, e – 4

(C) a – 5, b – 1, c – 2, d – 3, e – 4 (D) a – 3, b - 1, c – 4, d – 5, e – 2

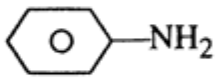
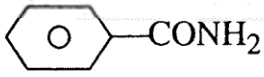
(E) a – 5, b – 2, c – 4, d – 3, e – 1

9. Which one of the following complexes is not diamagnetic?

(A) $[Fe(CN)_6]^{4-}$ (B) $[Ti(H_2O)_6]^{3+}$

(C) $[Pt(CN)_4]^{2-}$ (D) $[Co(NH_3)_6]^{3+}$ (E) $[Ni(CO)_4]$

10. Match the lists I and II and pick the correct matching from the codes given below

List I (Reactants)		List II (Products)
a. $RX + KCN$	$\xrightarrow{\text{Ethanol}}$	1. 
b. $RX + CH_3COOAg$	$\longrightarrow$	2. RCN
c. $H_3CC \equiv N$	$\xrightarrow{LiAlH_4}$	3. CH_3COOR
d. 	$\xrightarrow[\text{degradation}]{\text{Hofmann's}}$	4. $CH_3CH_2NH_2$
e. $R–NH_2$	$\xrightarrow[CHCl_3 / KOH]{\text{Carbylamine reaction}}$	5. RNC

(A) a – 3 ; b – 1 ; c – 2 ; d – 5 ; e – 4 (B) a – 2 ; b – 3 ; c – 4 ; d – 1 ; e – 5

(C) a – 3 ; b – 2 ; c – 1 ; d – 5 ; e – 4 (D) a – 5 ; b – 3 ; c – 2 ; d – 4 ; e – 1

(E) a – 4 ; b – 2 ; c – 3 ; d – 5 ; e – 1

11. The efficiency of an enzyme to catalyze a reaction is due to its capacity to

(A) Reduce the activation energy of the reaction

(B) Form strong enzyme – substrate complex

(C) Decrease the bond energy of all substrate molecules

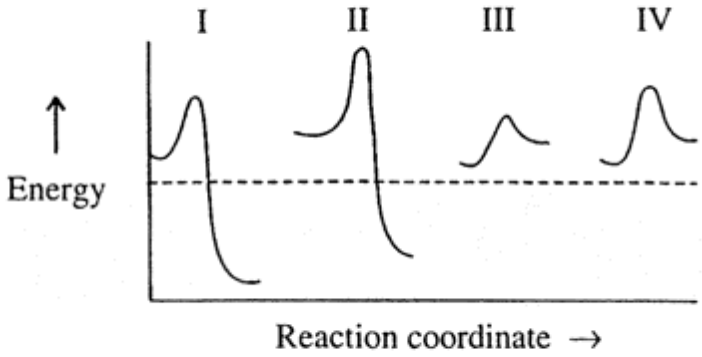
(D) Increase the free energy of the catalyst – substrate reaction

(E) Alter the substrate geometry to fit into the shape of the enzyme molecule

12. If 0.5 g of a solute (molar mass 100 g mol^{-1}) in 25 g of solvent elevates the boiling point by 1 K, the molar boiling point constant of the solvent is

(A) 2 (B) 8 (C) 5 (D) 0.5 (E) 10

13. The potential energy diagrams for four reactions are given below.



Which one of the following statements about these diagrams is INCORRECT?

(A) I has the largest rate constant for an exothermic reaction.

(B) II has the smallest rate constant for the reverse reaction.

(C) III will have the most rapid establishment of equilibrium

(D) IV has the largest rate constant for an endothermic reaction.

(E) The magnitude of the enthalpy of reaction I is greater than that of III.

14. The addition of Br_2 to Z-2-butene gives

(A) (R, R)-2, 3-Dibromo butane only

(B) (S, S)-2, 3-Dibromo butane only

(C) (R, S)-2, 3-Dibromo butane only

(D) A mixture of (R R) and (S S)-2, 3-dibromo butanes (50% : 50%)

(E) (R, S)-1, 2-Dibromo butane

15. Which of the following metals, Fe, Zn, Pb, Ag and Pt, DO NOT give a metal nitrate on treatment with concentrated HNO_3?

(A) Fe and Zn (B) Fe and Pt

(C) Pb, Ag and Pt (D) Fe, Ag and Pt (E) Fe, Zn and Pt

16. Which of the following factors are responsible for the increase in the rate of a surface catalysed reaction?

1. A catalyst provides proper orientation for the reactant molecules to react
2. Heat of adsorption of reactants on a catalyst helps reactant molecules to overcome activation energy
3. The catalyst increases the activation energy of the reaction
4. Adsorption increases the local concentration of reactant molecules on the surface of the catalyst

Select the correct answer using the code given below

(A) 1 and 2 (B) 1 and 3

(C) 2 and 4 (D) 1, 2 and 3 (E) 1, 2 and 4

17. The radioisotope of hydrogen has a half-life of 12.33 y. What is the age of an old bottle of wine whose $^{3}_{1}H$ radiation is 10% of that present in a new bottle of wine?

(A) 41 y (B) 123.3 y (C) 1.233 y (D) 410 y (E) 12.33 y

18. One of the different amino acids which can be synthesized in the body is

(A) lysine (B) histidine

(C) valine (D) phenyl alanine (E) alanine

19. Neopentyl bromide undergoes dehydrohalogenation to give alkene even though it has no β - hydrogen. This is due to

(A) E_2 mechanism (B) E_1 mechanism

(C) Due to rearrangement of carbo cation by E_1 mechanism

(D) E_1 CB mechanism (E) Hofmann elimination

20. If the aqueous solutions of the following salts are electrolysed for 1 hour with 10 ampere current, which solution will deposit the maximum mass of the metal at the cathode? The atomic weights are, Fe = 56, Zn = 65, Ag = 108, Hf = 178 and W = 184.

(A) $ZnSO_4$ (B) $FeCl_3$ (C) $HfCl_4$ (D) WCl_6 (E) $AgNO_3$

21. Which of the following statement is true?

(A) The kinetic energy of an electron is inversely proportional to square of its momentum.

(B) de Broglie wavelength associated with a particle is directly proportional to its mass.

(C) de Broglie wavelength associated with a particle is directly proportional to square of its velocity.

(D) The wavelength associated with an electron is directly proportional to square root of accelerating potential.

(E) The kinetic energy of an electron is directly proportional to accelerating potential.

22. Which species are more resonance stabilized in the following pairs?

$[C_6H_5Cl, C_6H_5CH_3]$, $[CH_2=CHCl, CH_2=CHCH_2Cl]$,

$[C_6H_5Br, C_6H_5CH_2Br]$, $[CH_3COOH, CH_3COO^-]$

(A) C_6H_5Cl, $CH_2=CHCH_2Cl$, $C_6H_5CH_2Br$, CH_3COO^-

(B) $C_6H_5CH_3$, $CH_2=CHCH_2Cl$, $C_6H_5CH_2Br$, CH_3COO^-

(C) $C_6H_5CH_3$, $CH_2=CHCH_2Cl$, $C_6H_5CH_2Br$, CH_3COOH

(D) C_6H_5Cl, $CH_2=CHCl$, C_6H_5Br, CH_3COOH

(E) C_6H_5Cl, $CH_2=CHCl$, C_6H_5Br, CH_3COO^-

23. Which one of the following statements about rocket propellants is NOT true?

(A) Rocket propellants have to burn in the absence of atmospheric oxygen

(B) Specific impulse is the criterion for propellant performance

(C) Liquid oxygen and hydrazine constitutes a liquid propellant

(D) A propellant consisting of liquid N_2O_4 and acrylic rubber is a double base propellant

(E) A blend of polyurethane, ammonium perchlorate and aluminium powder is a composite propellant

24. Dead burnt plaster is

(A) $CaSO_4 . 2H_2O$ (B) $MgSO_4 . 7H_2O$

(C) $CaSO_4 . ½ H_2O$ (D) $CaSO_4$ (E) $MgSO_4$

25. Match the lists I and II and pick the correct matching from the codes given below:

List I(Halo alkane/arane)	List II(Applications)
a. Iodoform	1. CF_4
b. BHC	2. antiseptic
c. Freon-14	3. moth repellent
d. Halothanes	4. inhalative anesthetic
e. *p*–dichlorobenzene	5. termite pesticide

(A) a – 2 ; b – 4 ; c – 5 ; d – 3 ; e – 1

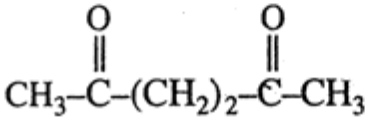
(B) a – 2 ; b – 5 ; c – 1 ; d – 4 ; e – 3

(C) a – 3 ; b – 4 ; c – 2 ; d – 1 ; e – 5

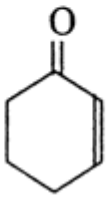
(D) a – 1 ; b – 3 ; c – 5 ; d – 2 ; e – 4

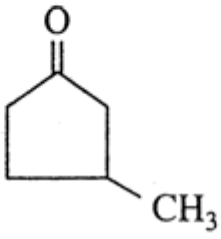
(E) a – 5 ; b – 4 ; c – 3 ; d – 2 ; e – 1

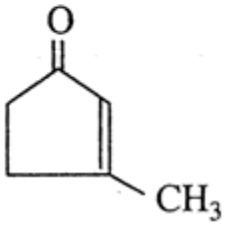
26. The diketone

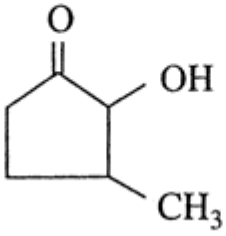


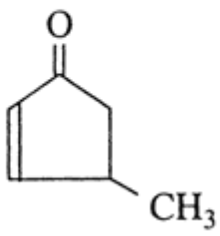
on intramolecular aldol condensation gives the final product

(A) 

(B) 

(C) 

(D) 

(E) 

27. The electronic configuration of four elements are

1. [Xe] $6s^1$
2. [Xe] $4f^{14}5d^16s^2$
3. [Ar] $4s^24p^5$
4. [Ar] $3d^74s^2$

Which one of the following statements about these elements is NOT correct?

(A) 1 is a strong reducing agent
(B) 2 is a d-block element
(C) 3 has high electron affinity
(D) 4 shows variable oxidation state
(E) The compound formed between 1 and 3 is ionic

28. Which of the following statements is / are NOT TRUE about the diagonal relationship of Be and Al.

(a) Both react with NaOH to liberate hydrogen
(b) Their oxides are basic
(c) They are made passive by nitric acid
(d) Their carbides give acetylene on treatment with water

(A) only (a) (B) (b) and (c)
(C) only (d) (D) (a) and (d) (E) (b) and (d)

29. Which one of the following statements about CH_3CN is not true?

(A) Its IUPAC name is ethanenitrile
(B) The bond between C and N is a triple bond
(C) The C-C-N bond angle is 180°
(D) The carbon-carbon bond is longer than the carbon-nitrogen bond
(E) It has a relatively high boiling point due to hydrogen bonding

30. For the homogeneous reaction $xA + yB \rightleftharpoons lY + mZ$

$\Delta H^\circ = -30$ kJ mol^{-1} and $\Delta S = -100$ JK mol^{-1}

At what temperature the reaction is at equilibrium?

(A) 50°C (B) 250°C (C) 100K (D) 27°C (E) 500K

31. The amount of copper deposited by one Faraday current will be maximum in an acidic solution of one litre of

(A) 1M Cu_2Cl_2 (B) 2M $Cu(NO_3)_2$

(C) 5M $CuSO_4$ (D) 5M $Cu_3(PO_4)_2$ (E) 10 M CuF_2

32. Which of the following molecule is planar?

(A) CH_4 (B) NH_3 (C) C_2H_4 (D) $SiCl_4$ (E) PCl_3

33. The number of isomers possible for disubstituted borazine, $B_3N_3H_4X_2$ is

(A) 3 (B) 4 (C) 6 (D) 2 (E) 5

34. The formula of compound which gives violet colour in Lassagine's test for sulphur with sodium nitroprusside is

(A) $Na_4[Fe(CN)_6S]$ (B) $Na_4[Fe(CN)_5NCS]$

(C) $Na_4[Fe(CN)_5NOS]$ (D) $Na_2[Fe(CN)_5NOS]$ (E) $Na_4[Fe(CN)_5S]$

35. The coagulation of 200 mL of a positive colloid took place when 0.73 g HCl was added to it without changing the volume much. The flocculation value of HCl for the colloid is

(A) 0.365 (B) 36.5 (C) 100 (D) 150 (E) 200

36. The strongest ortho-para and strongest meta-directing groups respectively are

(A) $-NO_2$ and $-NH_2$

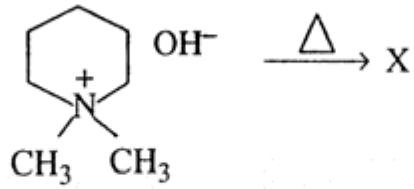
(B) $-CONH_2$ and $-NH_2$

(C) $-NH_2$ and $-CONH_2$

(D) $-X$ and $-CONH_2$

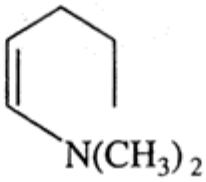
(E) $-NH_2$ and $-NO_2$

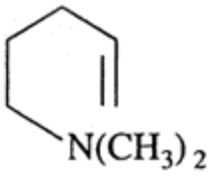
37. In the following reaction,

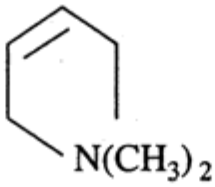


the organic product X has the structure

(A) 

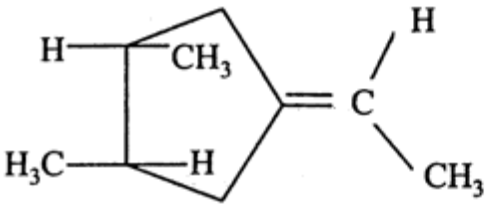
(B) 

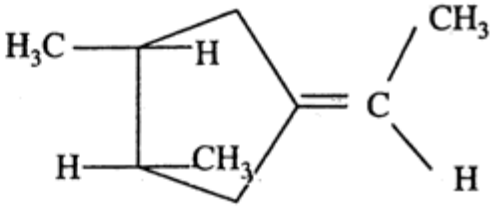
(C) 

(D) 

(E) 

38. Consider the structures given below





They are

(A) Enantiomers
(B) Diastereoisomers
(C) Geometrical isomers
(D) Homomers
(E) Meso isomers

39. When excess ammonia is added to $CuSO_4$ solution the deep blue complex obtained is

(A) Tetrahedral and Paramagnetic
(B) Tetrahedral and Diamagnetic
(C) Square Planar and Diamagnetic
(D) Square Planar and Paramagnetic
(E) Tetrahedral and Ferromagnetic

40. Among the following transition elements, pick out the element / elements with highest second ionization energy

(a) V (At. no = 23)
(b) Cr (At. no = 24)
(c) Mn (At. no = 25)
(d) Cu (At. no = 29)
(e) Zn (At. no = 30)

(A) (a) and (c) (B) (b) and (d)
(C) (b) and (e) (D) only (d) (E) only (c)

41. The angular momentum of an electron is zero. In which orbital may it be present?

(A) 2*s* (B) 2*p* (C) 3*d* (D) 4*f* (E) 5*f*

42. Which of the following will show geometrical isomerism?

(A) 2-Methyl butene (B) Propene
(C) Vinyl chloride (D) But-2-ene (E) 2-Methyl propene

43. Match the lists I and II and pick the correct matching from the codes given below

List I	List II
a. Propane-1,2,3-triol	1. Cyclic ether
b. Ethane-1,2-diol	2. Absolute ethanol + Petrol
c. Tetrahydrofuran	3. Dynamite
d. Power alcohol	4. Denatured alcohol
e. Methylated spirit	5. Terylene

(A) a – 1 ; b – 2 ; c – 3 ; d – 4 ; e – 5
(B) a – 1 ; b – 3 ; c – 5 ; d – 4 ; e – 2
(C) a – 3 ; b – 2 ; c – 4 ; d – 5 ; e – 1

44. The decreasing order of boiling points of the following hydrides

(a) NH_3 (b) PH_3 (c) AsH_3 (d) SbH_3 (e) H_2O

(A) (e) > (d) > (a) > (c) > (b) (B) (e) > (a) > (b) > (c) > (d)

(C) (b) > (d) > (c) > (a) > (e) (D) (d) > (c) > (a) > (b) > (e)

(E) (e) > (d) > (c) > (b) > (a)

45. A substance with initial concentration of '*a*' mol dm^{-3} reacts according to zero order kinetics. The time it takes for the completion of the reaction is (k = rate constant)

(A) k / a (B) $a / 2k$ (C) a / k (D) $2k / a$ (E) ka

46. Biotin is an organic compound present in yeast. Its deficiency in diet causes dermatitis and paralysis. It is also known as

(A) Vitamin H (B) Vitamin B_3

(C) Vitamin B_{12} (D) Vitamin D (E) Vitamin E

47. Pick out the wrong statement(s)

1. Vapour pressure of a liquid is the measure of the strength of intermolecular attractive forces.
2. Surface tension of a liquid acts perpendicular to the surface of the liquid.
3. Vapour pressure of all liquids is same at their freezing points.
4. Liquids with stronger intermolecular attractive forces are more viscous than those with weaker intermolecular forces.

(A) 2, 3 and 4 (B) 2 and 3

(C) 1, 2 and 3 (D) 3 only (E) 2 only

48. The equilibrium constant K_p for the thermal dissociation of PCl_5 at 200°C is 1.6 atm. The pressure (in atm) at which it is 50% dissociated at that temperature is

(A) 4.8 (B) 4.2 (C) 3.2 (D) 2.4 (E) 6.4

49. Consider the following reaction at 1000°C

(a) $Zn(s) + \frac{1}{2} O_2(g) \longrightarrow ZnO(s)$; $\Delta G° = -360\ kJmol^{-1}$.

(b) $C(gr) + \frac{1}{2} O_2(g) \longrightarrow CO(g)$; $\Delta G° = -460\ kJmol^{-1}$.

Choose the correct statement

At 1000°C

(A) Zinc can be oxidized by carbon monoxide

(B) Zinc oxide can be reduced by graphite

(C) Both statements (A) and (B) are true

(D) Both statements (A) and (B) are false

(E) Carbon monoxide can be reduced by zinc

50. Which of the following metal in solution forms a precipitate with NaOH, which is not soluble in an excess of the base?

(A) Fe (B) Sn (C) Pb (D) Zn (E) Al

51. In the solvolysis of 3-methyl-3-bromohexane, which of the following statement is not correct?

(A) It involves carbocation intermediate

(B) The intermediate involves sp^2 carbon

(C) Polar solvents accelerates the reaction

(D) The rate of the reaction depends upon 3-methyl-3-bromo hexane concentration

(E) It involves inversion of configuration

52. The following is known as "Bordeaux mixture"

(A) Borax and copper sulphate

(B) Orthoboric acid and ferrous sulphate

(C) Sodium borate and zinc sulphate

(D) Copper sulphate and lime

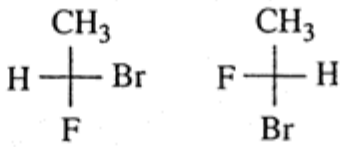
(E) Borax and manganous sulphate

53. Which among the following will give a precipitate with ammonical silver nitrate?

(A) 2-Butene (B) 2-Butyne (C) Chlorobenzene

(D) 3-Methyl-1-butyne (E) 1,3-Butadiene

54. Consider the following representation



They are

(A) enantiomers (B) diastereomers

(C) conformational isomers (D) identical (E) cis-trans isomers

55. One mole of an unsaturated hydrocarbon on ozonolysis gives one mole each of CH_3CHO, HCHO and OHC.CHO. The hydrocarbon is

(A) $CH_3.CH_2C{\equiv}C.CH_3$ (B) $CH{\equiv}C.CH_2.CH_2.CH_3$

(C) $CH_3.CH{=}CH.CH{=}CH_2$ (D) $CH_2{=}CH.CH_2.CH{=}CH_2$

(E) $CH_2{=}C{=}CH.CH_2.CH_3$

56. Which one of the following compounds is used as a body deodorant?

(A) Aspirin (B) Omeprazole

(C) Indigosol-O (D) p-chlorometaxylenol (E) Bithional

57. The rate of the reaction $A+2B \rightarrow 3C$ gets increased by 72 times when the concentration of A is tripled and that of B is doubled. The order of the reaction with respect to A and B are ---- and ---- respectively.

(A) 1, 2 (B) 2, 3 (C) 3, 2 (D) 2, 2 (E) 2, 1

58. Which of the following is not in greenhouse gas?

(A) CO_2 (B) CH_4 (C) O_3 (D) N_2 (E) CCl_2F_2

59. KBr is 80% dissociated in aqueous solution of 0.5M concentration. (Given K_f for water = 1.86 K kg mol^{-1}). The solution freezes at

(A) 271.326 K (B) 272 K (C) 270.5 K (D) 268.5 K (E) 269 K

60. In a polymer sample 30% of molecules have a molecular mass 20,000, 40% have 30,000 and the rest 60,000. What is the weight average molecular mass of the polymer?

(A) 40,300 (B) 30,600 (C) 43,333 (D) 50,400 (E) 33,333

61. Match the lists I and II and pick the correct matching from the codes given below

List I(Atomic / Molecular Species)	List II(Corresponding pairs)
a. Isotope	1. $^{228}Ra_{88}$ & $^{228}Ac_{89}$
b. Isobar	2. $^{39}Ar_{18}$ & $^{40}K_{19}$
c. Isotone	3. $^{2}H_{1}$ & $^{3}H_{1}$
d. Isosters	4. $^{235}U_{92}$ & $^{231}Th_{90}$
e. Isodiaphers	5. CO_2 & N_2O

(A) a – 2 ; b – 1 ; c – 4 ; d – 5 ; e – 3

(B) a – 2 ; b – 5 ; c – 1 ; d – 4 ; e – 3

(C) a – 3 ; b – 1 ; c – 2 ; d – 5 ; e – 4

(D) a – 5 ; b – 4 ; c – 1 ; d – 2 ; e – 3

(E) a – 5 ; b – 3 ; c – 1 ; d – 2 ; e – 4

62. Which pair of the gases diffuses with the same rate at same temperature and pressure?

(A) CO and NO (B) NO_2 and CO_2

(C) NH_3 and PH_3 (D) NO and C_2H_6 (E) Cl_2 and SO_2

63. Among the following complexes, which has a magnetic moment of 5.9 BM?

$Ni(CO)_4$, $[Fe(H_2O)_6]^{2+}$, $[CO(NH_3)_6]^{3+}$, $[MnBr_4]^{2-}$, $[Zn(NH_3)_4]^{2+}$

(A) $Ni(CO)_4$ (B) $[Fe(H_2O)_6]^{2+}$

(C) $[CO(NH_3)_6]^{3+}$ (D) $[MnBr_4]^{2-}$ (E) $[Zn(NH_3)_4]^{2+}$

64. In the Victor-Meyer's test, the colours given by 1°, 2° and 3° alcohols are, respectively

(A) red, colourless, blue (B) red, blue, colourless

(C) colourless, red, blue (D) red, blue, violet

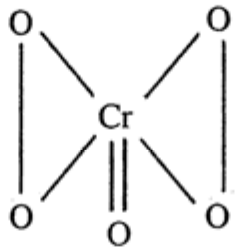
(E) blue, red, violet

65. A particular solid is very hard and has a high melting point. In solid state it is a non conductor and its melt is a conductor of electricity. Classify the solid

(A) Metallic (B) Molecular

(C) Network (D) Ionic (E) Amorphous

66. CrO_5 has a structure as shown



The oxidation number of chromium in the above compound is

(A) 4 (B) 5 (C) 6 (D) 10 (E) 0

67. Which one of the following statements about diborane is NOT true?

(A) The B atoms in it are sp^3 hybridised
(B) It contains two 3-centre-2-electron bonds
(C) All B-H bond lengths in it are equal due to resonance
(D) The molecule is non-planar
(E) The molecule contains 12 valence electrons

68. Which of the following is not aromatic?

(A) Benzene (B) Cyclopropenyl cation

(C) Trophyliumcation (D) Cyclopentadienyl cation

(E) Cyclopentadienyl anion

69. Shorter the radioactive half life

(A) Greater is the number of atoms disintegrating per second.

(B) Smaller is the decay constant.

(C) Less reactive is the parent nucleus.

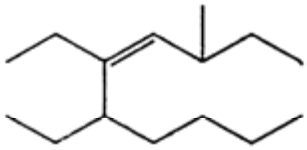
(D) Greater is the mass-energy change.

(E) Greater is the average life.

70. 0.59 g of the silver salt of an organic acid (molar mass 210) on ignition gave 0.36 g of pure silver. The basisity of the acid is

(A) 3 (B) 2 (C) 1 (D) 4 (E) 5

71. Consider the following compound



IUPAC name of this compound is

(A) 5,6-Diethyl-3-methyl decane (B) 5,6-Diethyl-3-methyl dec-4-ene

(C) 3,5,6-Trimethyl-dec-6-ene (D) 3,5,6-Triethyl-dec-4-ene

(E) 5,6-Diethyl-8-methyl-dec-6-ene

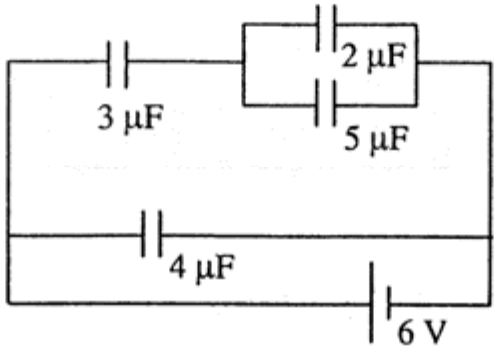
72. The element that does not exhibit positive oxidation state is

(A) Fe (B) Cl (C) O (D) N (E) F

73. An electron revolves in a circle of radius 0.4Å with a speed of 10^5 ms^{-1} The magnitude of the magnetic field, produced at the center of the circular path due to the motion of the electron, in weber $metre^{-2}$ is

(A) 0.01 (B) 10.0 (C) 1.0 (D) 0.005 (E) 5

74. Consider the circuit given below.



The charge in μC on the capacitor having capacity 5 μF is

(A) 21 (B) 3.6 (C) 9 (D) 12.6 (E) 18

75. The work done by a force $\vec{F}=(-6x^3\hat{i})$ N, in displacing a particle from $x = 4$ m to $x = -2$ m is

(A) 360 J (B) 240 J (C) – 240 J (D) –360 J (E) 408 J

76. Two forces of 5 N and 12 N simultaneously act on a particle. The net force on the particle is

(A) 17 N only (B) 12 N (C) 13 N

(D) between 7 N and 17 N (E) 7 N only

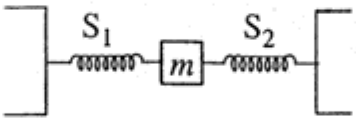
77. If the acceleration due to gravity on the surface of earth of radius R is g, the gain in potential energy of a body of mass m raised from the surface to a height R is

(A) $4mgR$ (B) $mgR/4$ (C) $mgR/2$ (D) $2mgR$ (E) mgR

78. The core of a transformer is laminated to

(A) increase the magnetic flux linked.
(B) reduce the power loss due to eddy current.
(C) reduce the flux leakage loss.
(D) reduce copper loss.
(E) reduce hysteresis loss.

79. In the given diagram S_1 and S_2 are identical springs.



The frequency of oscillation of the mass 'm' is f. If one of the springs is removed, the frequency will be

(A) f (B) $2f$ (C) $\sqrt{2}f$ (D) $\frac{f}{\sqrt{2}}$ (E) $\frac{f}{2}$

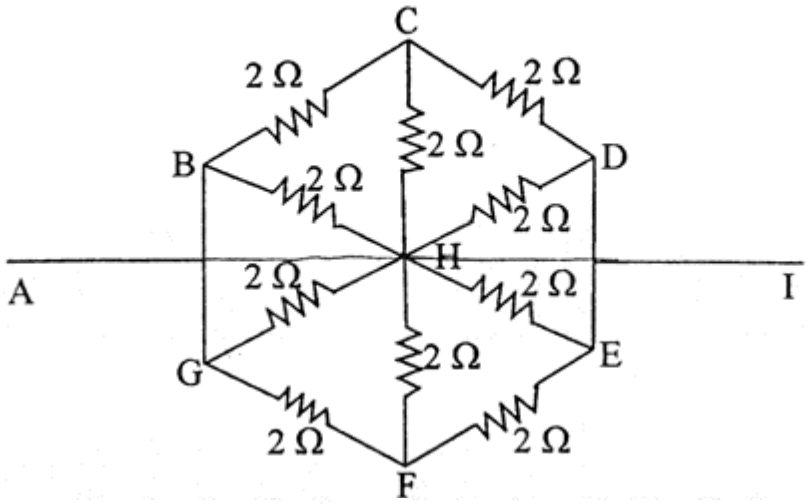
80. A body cools from 50°C to 49.9°C in 5 s. How long will it take to cool from 40°C to 39.9°C? Assume the temperature of the surroundings to be 30°C and Newton's law of cooling to be valid

(A) 2.5 s (B) 5 s (C) 20 s (D) 10 s (E) 15 s

81. Two stretched strings of same material are vibrating under same tension in fundamental mode. The ratio of their frequencies is 1:2 and ratio of the length of the vibrating segments is 1:4. Then the ratio of the radii of the strings is

(A) 2:1 (B) 4:1 (C) 3:2 (D) 8:1 (E) 4:5

82. The effective resistance across the points A and I is



(A) 2 Ω (B) 1 Ω (C) 0.5 Ω (D) 5 Ω (E) 10 Ω

83. Blood is flowing at the rate of 200 $cm^3 s^{-1}$ in a capillary of cross sectional area 0.5 m^2. The velocity of flow, in mm s^{-1}, is

(A) 0.1 (B) 0.2 (C) 0.3 (D) 0.4 (E) 0.5

84. The area of the region covered by the TV broadcast by a TV tower of 100 m height is (radius of the earth $=6.4\times10^6$m)

(A) $12.8\,\pi\times10^8$ km^2 (B) $1.28\,\pi\times10^3$ km^2

(C) $0.64\,\pi\times10^3$ km^2 (D) 1.28×10^3 km^2

(E) $2.56\,\pi\times10^3$ km^2

85. The electrical conductivity of a semiconductor increases when an electromagnetic radiation of wavelength shorter than 1125 nm is incident on it. The band gap of the semiconductor is

(A) 0.9 eV (B) 0.7 eV (C) 0.5 eV (D) 0.8 eV (E) 1.1 eV

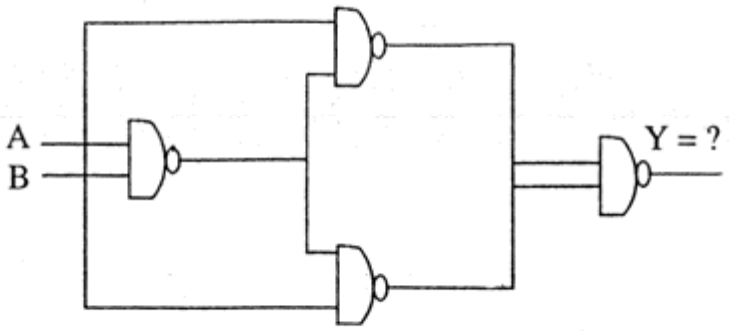
86. 4 cells each of emf 2 V and internal resistance of 1 Ω are connected in parallel to a load resistor of 2 Ω. Then the current through the load resistor is

(A) 2 A (B) 1.5 A (C) 1 A (D) 0.888 A (E) 0.75 A

87. To what depth below the surface of sea should a rubber ball be taken as to decrease its volume by 0.1%? [Take: density of sea water = 1000 kgm^{-3}, Bulk modulus of rubber = 9×10^{8} Nm^{-2}; acceleration due to gravity =10 ms^{-2}]

(A) 9 m (B) 18 m (C) 180 m (D) 90 m (E) 900 m

88. Select the outputs Y of the combination of gates shown below for inputs A=1, B = 0; A = 1, B =1 and A = 0, B = 0 respectively.



(A) (0 1 1) (B) (0 0 1) (C) (1 0 1) (D) (1 1 1) (E) (1 0 0)

89. Of the following which is preferred modulation scheme for digital communication?

(A) Pulse Code Modulation (PCM)

(B) Pulse Amplitude Modulation (PAM)

(C) Pulse Position Modulation (PPM)

(D) Pulse Width Modulation (PWM)

(E) Pulse Time Modulation (PTM)

90. In a Fraunhofer diffraction at single slit of width '*d*' with incident light of wavelength 5500 Å, the first minimum is observed, at angle 30°. The first secondary maximum is observed at an angle θ =

(A) $\sin^{-1}\frac{1}{\sqrt{2}}$ (B) $\sin^{-1}\frac{1}{4}$ (C) $\sin^{-1}\frac{3}{4}$ (D) $\sin^{-1}\frac{\sqrt{3}}{2}$ (E) $\sin^{-1}\frac{3}{8}$

91. A thermos flask made of stainless steel contains several tiny lead shots. If the flask is quickly shaken, up and down several times, the temperature of lead shots

(A) Increases by adiabatic process
(B) Increases by isothermal process
(C) Decreases by adiabatic process
(D) Remains same
(E) First decreases and then increases

92. The slope of the kinetic energy versus position vector gives the rate of change of

(A) momentum (B) velocity (C) force
(D) power (E) work

93. The total electrical flux leaving a spherical surface of radius 'r' m enclosing an electric dipole of charge q is,

(A) zero (B) $\frac{q}{\varepsilon_0}$ (C) $\frac{8\pi r^2 q}{\varepsilon_0}$ (D) $\frac{2q}{\varepsilon_0}$ (E) $\frac{4\pi r^2 q}{\varepsilon_0}$

94. A current I = 10 sin (100 π t) A is passed in first coil, which induces a maximum emf of 5 π V in second coil. The mutual inductance between the coils is

(A) 10 mH (B) 15 mH (C) 25 mH (D) 20 mH (E) 5 mH

95. What is the effect on the time period of a simple pendulum if the mass of the bob is doubled?

(A) halved (B) doubled
(C) becomes eight times (D) becomes zero (E) no effect

96. A particle is released from rest from a tower of height $3h$. The ratio of the intervals of time to cover three equal heights h is

(A) $t_1 : t_2 : t_3 = 3 : 2 : 1$
(B) $t_1 : t_2 : t_3 = 1 : (\sqrt{2}-1) : (\sqrt{3}-2)$
(C) $t_1 : t_2 : t_3 = 1 : \sqrt{2} : \sqrt{3}$
(D) $t_1 : t_2 : t_3 = \sqrt{3} : \sqrt{2} : 1$
(E) $t_1 : t_2 : t_3 = 1 : (\sqrt{2}-1) : (\sqrt{3}-\sqrt{2})$

97. After how many days will (1/20)th of the radioactivity element remain behind, if the half-life of the element is 6.931 days?

(A) 25.12 days (B) 28.32 days (C) 29.96 days

(D) 23.03 days (E) 27.72 days

98. Moment of inertia of a body does not depend upon its

(A) mass (B) axis of rotation (C) shape

(D) distribution of mass (E) angular velocity

99. A nucleus has 6 protons and 6 neutrons. The volume of the nucleus in $(\text{fermi})^3$ [Given $R_0 = 1.3$ fm] is

(A) 60.28 (B) 101.35 (C) 25.0 (D) 110.4 (E) 125.5

100. What is the escape velocity for a body on the surface of a planet on which the acceleration due to gravity is $(3.1)^2\ ms^{-2}$ and whose radius is 8100 km?

(A) 2790 $km.s^{-1}$ (B) 27.9 $km.s^{-1}$ (C) $\frac{27.9}{\sqrt{5}} km.s^{-1}$

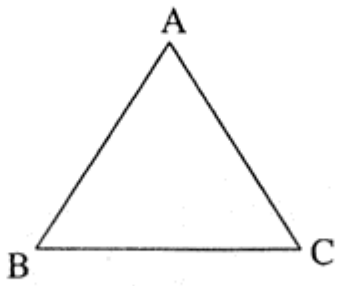
(D) $27.9\sqrt{5}\ km.s^{-1}$ (E) $\frac{2.79}{\sqrt{5}} km.s^{-1}$

101. Which one of the following is not a derived unit?

(A) frequency (B) Planck's constant

(C) gravitational constant (D) charge (E) electric current

102. Three identical charges each of 2μC are placed at the vertices of a triangle ABC as shown in the figure



If AB + AC = 12 cm and AB.AC = 32 cm^2, the potential energy of the charge at A is

(A)1.53 J (B) 5.31 J (C) 3.15 J (D) 1.35 J (E) 3.51 J

103. The diagonals of a parallelogram are represented by vectors $\vec{p} = 5\hat{i} - 4\hat{j} + 3\hat{k}$ and $\vec{q} = 3\hat{i} + 2\hat{j} - \hat{k}$. Then the area of the parallelogram is

(A) $\sqrt{171}$ units (B) $\sqrt{72}$ units (C) 171 units

(D) 72 units (E) $\sqrt{191}$ units

104. A block released from rest from the top of a smooth inclined plane of inclination 45° takes time t to reach the bottom. The same block released from rest from top of a rough inclined plane of the same inclination takes time $2t$ to reach the bottom. The coefficient of friction is

(A) 0.75 (B) 0.5 (C) 0.25 (D) 0.4 (E) 0.33

105. A solid cylinder rolls down an inclined plane of height 3 m and reaches the bottom of plane with angular velocity of $2\sqrt{2}$ rad. s^{-1}. The radius of cylinder must be [Take g=10 m s^{-2}]

(A) 5 cm (B) 0.5 m (C) $\sqrt{10}$ cm (D) $\sqrt{5}$ m (E) 10 cm

106. The SKIP ZONE in Radio Wave Transmission is that range where

(A) there is no reception of either ground wave or sky wave

(B) the reception of ground wave is maximum but that of sky wave is minimum

(C) the reception of ground wave is minimum, but that of sky wave is maximum

(D) the reception of both ground and sky wave is maximum

(E) the reception of both ground and sky wave is minimum

107. The correct arrangement of colours in the descending order of their wavelengths is

(A) yellow, violet, green, orange

(B) orange, yellow, green, violet

(C) violet, green, yellow, orange

(D) yellow, green, orange, violet

(E) orange, green, violet, yellow

108. The velocity of sound is v at 273 K. The temperature at which it is $2v$ is

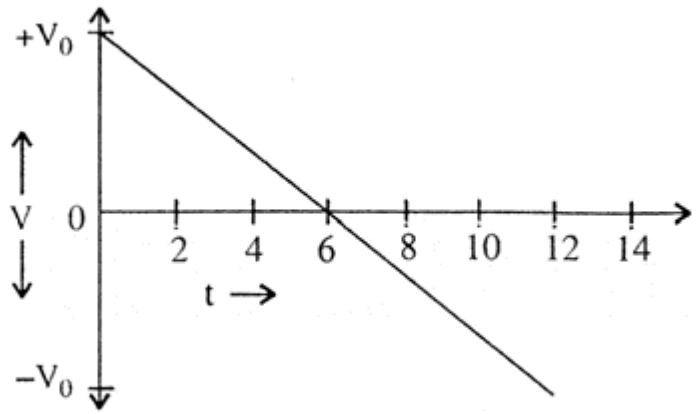
(A) 2×273 K (B) 4×273 K

(C) 8×273 K (D) 16×273 K (E) $\sqrt{2} \times 273$ K

109. Same force acts on two bodies of different masses 3 kg and 5 kg initially at rest. The ratio of times required to acquire same final velocity is

(A) 5 : 3 (B) 25 : 9 (C) 9 : 25 (D) $\sqrt{3} : \sqrt{5}$ (E) 3 : 5

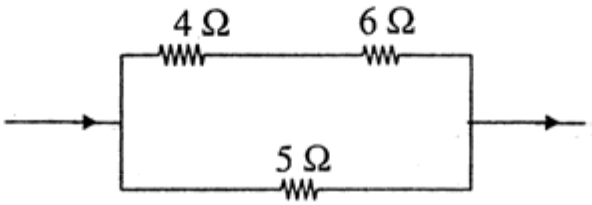
110. Consider the given velocity-time graph.



It represents the motion of

(A) a projectile projected vertically upward, from a point
(B) an electron in the hydrogen atom
(C) a car with constant acceleration along a straight road
(D) a bullet fired horizontally from the top of a tower
(E) an object in the positive direction with decreasing speed

111. In a given circuit, the heat produced in the 5 Ω resistor due to the current flowing through it is 10 Js^{-1} . The heat generated in the 4 Ω resistor is



(A) 4 Js^{-1} (B) 1.6 Js^{-1} (C) 2 Js^{-1} (D) 8 Js^{-1} (E) 34.7 Js^{-1}

112. To decrease the volume of a gas by 5% at constant temperature, the pressure should be

(A) decreased by 5.26% (B) increased by 5.26%
(C) decreased by 11% (D) increased by 11%
(E) increased by 15 %

113. The magnifying power of objective of a compound microscope is 5. If the magnifying power of microscope is 30, then magnifying power of eyepiece will be

(A) 0.17 (B) 6 (C) 3 (D) 25 (E) 35

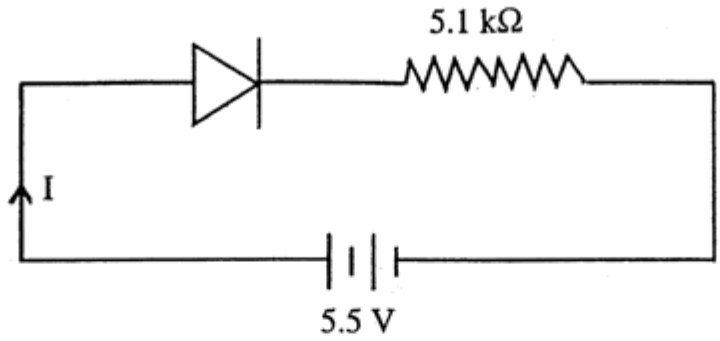
114. A block of wood weighs 4N in air and 3N when immersed in a liquid. The buoyant force in newton is

(A) zero (B) 1 (C) 3/4 (D) 4/3 (E) 7

115. A 16μF capacitor is charged to a 20 volt potential. The battery is then disconnected and pure 40 mH coil is connected across the capacitor so that LC oscillations are setup. The maximum current in the coil is

(A) 0.2 A (B) 40 mA (C) 2 A (D) 0.4 A (E) 0.8 A

116. A PN junction diode is connected to a battery of emf 5.5 V and external resistance 5.1 kΩ. The barrier potential in the diode is 0.4 V. The current in the circuit is



(A) 1.08 mA (B) 0.08 mA (C) 1 mA (D) 1 A (E) 2 mA

117. A concave lens of focal length 20 cm produces an image half the size of the real object. The distance of the real object is

(A) 20 cm (B) 30 cm (C) 10 cm (D) 60 cm (E) 40 cm

118. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum is

(A) $\frac{q}{2m}$ (B) $\frac{q\omega r^2}{2}$ (C) $\frac{q\omega}{2mr^2}$ (D) $\frac{q\omega r^2}{2m}$ (E) $\frac{\omega}{2r}$

119. Two tangent galvanometers with coils of same radii are connected in series. If the deflections are 30° and 45° respectively for a current of 1 A, then the turns ratio is

(A) 1 : 1 (B) 1 : 2 (C) $\sqrt{3}$: 1 (D) $\sqrt{3}$: 2 (E) 1 : $\sqrt{3}$

120. If the kinetic energy of the particle is increased by 16 times, the percentage change in the de Broglie wavelength of the particle is

(A) 25% (B) 75% (C) 60% (D) 50% (E) 30%
