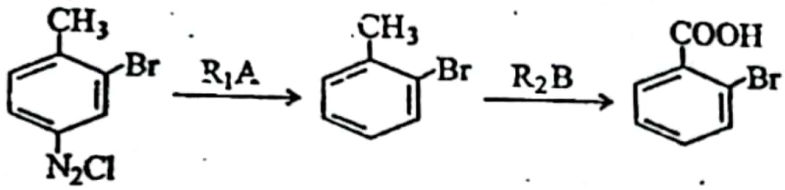
1. Reagents R_1A and R_2B in the following reactions are



(a) Sn, HCl and $NaNO_2$, HCl

(b) H_3PO_2, H_2O and $KMnO_4$, $\bar{O}H$

(c) HBF_4 and $KMnO_4$, $\bar{O}H$

(d) H_3PO_2, H_2O and Sn, HCl

2. Select the correct group of compounds from the following that gave yellow precipitate on reaction with iodine and sodium hydroxide

I. 1-Phenyl ethanol

II. Butan-2-ol

III. Pentan-3-ol

IV. Pentan-2-one

(a) I, II, III

(b) II, III, IV

(c) I, II, IV

(d) I, III, IV

3. Which one of the following compound is not prepared by Gabriel phthalimide synthesis?

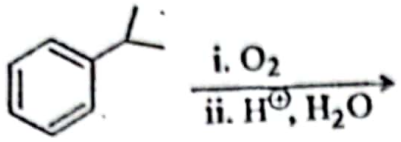
(a) $PhNH_2$

(b) $PhCH_2NH_2$

(c) $C_2H_5NH_2$

(d) $HC{\equiv}CCH_2NH_2$

4. By-product of the following reaction is



(a) Acetone
(b) Isopropyl alcohol
(c) Acetaldehyde
(d) Acetic acid

5. The correct order of increasing acidic nature of the following compound is

θ-Chlorophenol, θ-Cresol, θ-Nitrophenol, Picric acid
I II III IV

(a) I < II < III < IV
(b) II < I < III < IV
(c) III < II < I < IV
(d) I < III < II < IV

6. A linkage between two monosaccharide units through oxygen atom is known as

(a) Peptide linkage
(b) Phosphodiester linkage
(c) Ester linkage
(d) Glycosidic linkage

7. In an adsorption experiment, a graph between log (n/m) versus log P was found to be linear with a slope of 45° and the intercept was 0.3010. The amount of the gas adsorbed per gram of charcoal under a pressure of 0.5 atom will be

(a) 1.5
(b) 1.0
(c) 0.5
(d) 0.25

8. The melting point of benzene is 5.5 °C. What is the sign of ΔH, ΔS and ΔG for melting point of benzene at 0 °C

(a) $\Delta H > 0, \Delta S > 0, \Delta G > 0$
(b) $\Delta H < 0, \Delta S > 0, \Delta G < 0$
(c) $\Delta H > 0, \Delta S > 0, \Delta G < 0$
(d) $\Delta H > 0, \Delta S < 0, \Delta G > 0$

9. When a direct current is passed through an aqueous concentrated solution of NaCl which statement is true?

(a) pH of the solution decreases
(b) Chlorine gas will be liberated at the anode
(c) Metallic sodium will be deposited at the cathode
(d) Both (a) and (b) are true

10. B^- ions form a close packed structure. If the radius of B^- ion is 200 pm then the cation (A^+) having radii 88 pm can fit into

(a) tetrahedral hole
(b) octahedral hole
(c) both of them
(d) none of them

11. At a certain temp, equilibrium constant (K_c) is 16 for the reaction,

$$SO_2(g) + NO_2(g) \rightleftharpoons SO_3(g) + NO(g)$$

If one mole of each of the four gases are taken in one litre container, the equilibrium concentration of NO will be

(a) 0.4 mole
(b) 1.6 mole
(c) 0.6 mole
(d) 0.66 mole

12. The enthalpy of formation of water is,
[Given that the bond energies of H–H, O=O and O–H bonds are 433 kJ/mol, 492 kJ/mol and 464 kJ/mol, respectively]

(a) 430 kJ/mol
(b) –249 kJ/mol
(c) –461 kJ/mol
(d) 215 kJ/mol

13. 2 moles PCl_5 were introduced in a 2 L flask and heated at 625 K to establish equilibrium when 60% of PCl_5 was dissociated into PCl_3 and Cl_2. The equilibrium constant is

(a) 0.90
(b) 1.8
(c) 0.128
(d) 0.53

14. The standard reduction potential for Zn^{2+}/Zn, Ni^{2+}/Ni and Fe^{2+}/Fe are –0.80 V, –0.25 V and –0.45 V, respectively. The reaction $X + Y^{2+} \rightarrow X^{2+} + Y$ will be spontaneous when

(a) X = Ni, Y = Fe
(b) X = Ni, Y = Zn
(c) X = Zn, Y = Ni
(d) X = Fe, Y = Zn

15. The Gibbs free energy for the decomposition of Al_2O_3 at 500 °C is 482.5 kJ/mol. The potential difference needed for electrolytic reduction of Al_2O_3 at 500 °C is at least

(a) 2.5 V

(b) 5.0 V

(c) 1.25 V

(d) 4.5 V

16. The reaction is,

$2A + B + C \rightarrow A_2B + C$, $k = 2 \times 10^{-6} mol^{-2} L^2 s^{-1}$. The initial concentration of [A] = 0.05 mol/L, [B] = 0.1 mol/L and [C] = 0.5 mol/L. The rate after 0.04 mol/L of A has reacted, will be

(a) 1.28×10^{-8}

(b) 1.28×10^{-10}

(c) 1.60×10^{-8}

(d) 1.60×10^{-10}

17. Which of the following is not a true statement?

(a) Joule-Thomson effect is isoenthalpic process

(b) The positive value of μ_{JT} implies cooling effect

(c) The negative value of μ_{JT} implies cooling effect

(d) At inversion temperature, $\mu_{JT} = 0$

18. What will be solubility of $KAl(SO_4)_2$ in water if solubility product (K_{sp}) for $KAl(SO_4)_2$ is 1.6×10^{-11} (unit)

(a) 6×10^{-5} M

(b) 3×10^{-4} M

(c) 2×10^{-6} M

(d) 1.4×10^{-3} M

19. The following cell has a potential of 0.27 V at 25 °C

$Pt(s)|H_2(atm)|H^+(?M)||Ni^{2+}(1M)|Ni$

What is the pH of the solution in anodic compartment?

(a) 2.6

(b) 5.9

(c) 8.9

(d) 5.3

20. The solubility of a salt is 'S' and the solubility product is $4\ S^3$. The ratio cations to anions in the salt is

(a) 1:1

(b) 1:2

(c) 1:4

(d) 4:1

21. Which of the following is pH of solution formed by mixing 0.2 M NH_4Cl a 0.1 M NH_3. The pOH of ammonia solution is 4.75 ?

(a) 9.85

(b) 7.05

(c) 6.95

(d) 8.95

22. The rate law for the reaction described by $N_2O_2(g) \rightarrow 2NO(g)$ is first order the concentration of $N_2O_2(g)$. The expression for the time dependent behavic of the product concentration [NO] is

(a) $[NO] = 2[N_2O_2]_0(1-e^{-kt})$

(b) $[NO] = [N_2O_2]_0(1-e^{-kt})$

(c) $[NO] = 2[N_2O_2]_0\ e^{-kt}$

(d) $[NO] = [N_2O_2]_0\ e^{-kt}$

where $[N_2O_2]_0$ is the initial concentration of N_2O_2 i.e. constant

23. The conjugate acid of O^{2-} is

(a) O_2

(b) O_2^-

(c) H_2O

(d) OH^-

24. The oxidation states of Pt in $[Pt(NH_3)_4]$ $[PtCl_4]$ is

(a) +1 and +1

(b) +1 and +2

(c) +2 and +2

(d) +2 and +1

25. The most common oxidation state in lanthanide group is

(a) +2

(b) +3

(c) +4

(d) +6

26. Correct order of Lewis acid character of boron trihalides is

(a) $BF_3 > BCl_3 > BBr_3$

(b) $BF_3 > BBr_3 > BCl_3$

(c) $BCl_3 > BF_3 > BBr_3$

(d) $BBr_3 > BCl_3 > BF_3$

27. The hybridization and geometry in $N(SiH_3)_3$, respectively, are

(a) sp^3, tetrahedral

(b) sp^3, pyramidal

(c) sp^2, triangular planar

(d) sp^3d, T-shaped

28. The number of P–O–P bonds in trimetaphosphoric acid is/are

(a) 0

(b) 2

(c) 3

(d) 6

29. Which of the following ions has zero CFSE in octahedral field?

(a) Cr^{3+} (high spin)

(b) Co^{2+} (low spin)

(c) Fe^{3+} (low spin)

(d) Fe^{3+} (high spin)

30. The basicities of H_3PO_3 and $H_4P_2O_7$, respectively, are

(a) 1 and 4

(b) 2 and 4

(c) 3 and 4

(d) 2 and 3

31. The complexes $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ are, respectively

(a) tetrahedral and square planar

(b) tetrahedral and tetrahedral

(c) square planar and square planar

(d) square planar and tetrahedral

32. According to VSEPR theory, the geometry of ammonia and water mole will, respectively, be

(a) pyramidal and bent

(b) tetrahedral and pyramidal

(c) bent and pyramidal

(d) pyramidal and tetrahedral

[I

33. Crystal field splitting energy for octahedral (Δ_0) and tetrahedral (Δ_t) complexes is related as

(a) $\Delta_t \approx \frac{4}{9}\Delta_0$

(b) $\Delta_t \approx \frac{1}{2}\Delta_0$

(c) $\Delta_0 \approx 2\Delta_t$

(d) $\Delta_0 \approx \frac{4}{9}\Delta_t$

34. The number of S–S bonds in sulphur trioxide trimer (S_3O_9) is

(a) 3

(b) 2

(c) 1

(d) 0

35. Which of the following system has maximum number of unpaired electrons?

(a) d^6 (tetrahedral, high spin)

(b) d^9 (octahedral)

(c) d^4 (octahedral, low spin)

(d) d^7 (octahedral, high spin)

36. Basicity of dithionic acid is

(a) Two

(b) One

(c) Three

(d) Four

37. Catalyst used for the following reaction $2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$

(a) Fe powder
(b) Fe^{+2}
(c) Fe^{3+}
(d) Pt

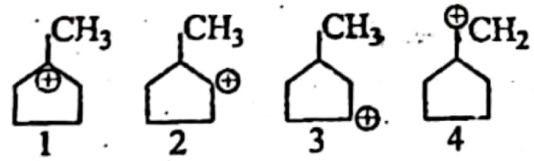
38. The test of NO_3^- ion through formation of brown ring is accompanied l reduction of NO_3^- ion into NO by an ion

(a) H_3O^+
(b) OH^-
(c) Fe^{2+}
(d) Fe^{3+}

39. The species analogous to paramagnetic behaviour like O_2

(a) Monoclinic sulphur
(b) Rhombic sulphur
(c) Colloidal sulphur
(d) Gaseous sulphur

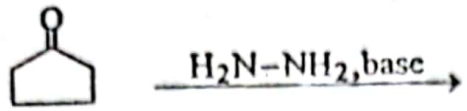
40. Consider the following carbocations



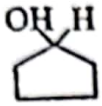
The decreasing order of stability of these carbocations will be

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

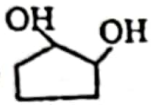
41. Select the product formed in the following reaction

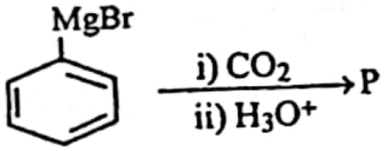


(a) 

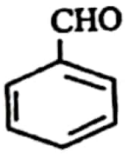
(b) 

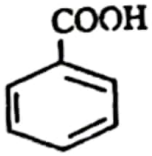
(c) 

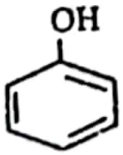
(d) 

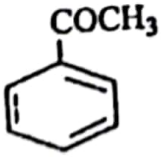
42. 

In the above reaction, product P is

(a) 

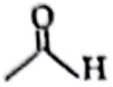
(b) 

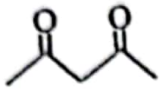
(c) 

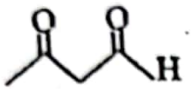
(d) 

43. The maximum enol content is in

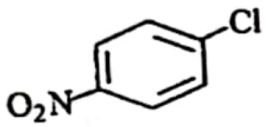
(a) 

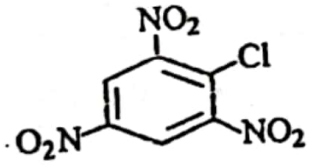
(b) 

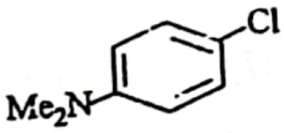
(c) 

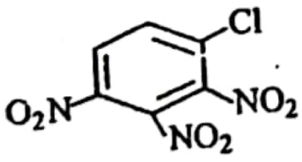
(d) 

44. Which of the following derivatives of benzene would undergo hydrolysis readily with aq. KOH?

(a) 

(b) 

(c) 

(d) 

51. A tractor has its rear wheel with radius 1.0 m and front wheel of radius 0.25 m. The rear wheel is rotating at 100 rev/min. Calculate the angular speed of the front wheel and the distance covered by the tractor in 10 minutes

(a) 400 rev/min, 6.28×10^3 m

(b) 300 rev/min, 5.17×10^3 m

(c) 200 rev/min, 3.14×10^3 m

(d) 100 rev/min, 1.57×10^3 m

52. A stone is thrown from the top of a building with an initial downward velocity of 20 m/s. The top of the building is 60 m above the ground. Calculate the time taken (in seconds) by the stone to hit the ground
(Given $g = 10$ m/s^2)

(a) 2

(b) 3

(c) 4

(d) 5

53. If $\vec{A} = \vec{i} - \vec{j}$ and $\vec{B} = 3\vec{i} + 4\vec{j}$, the vector having same magnitude as $\vec{B}$ but parallel to vector $\vec{A}$ can be written as

(a) $5(\vec{i} - \vec{j})$

(b) $(5/\sqrt{2})(\vec{i} - \vec{j})$

(c) $\sqrt{2}(4\vec{i} - 3\vec{j})$

(d) $\sqrt{3}(\vec{i} + \vec{j})$

54. A father is racing with his son has half the kinetic energy of the son who has half the mass of the father. If the father speeds up by 1 m/s then he would have the same kinetic energy as the son. Calculate the original speed (in m/s) of the father

(a) 2.4

(b) 3.2

(c) 4.6

(d) 5.8

55. A 6.0 kg block is placed on a 60° ramp as shown in the figure. The coefficient of static friction is 0.6. A force $\vec{F}$ is applied that puts the block on the verge of sliding down the ramp. The value of force F in Newtons is

(Given : $\sqrt{3}$ =1.73 and $g = 9.8\ m/s^2$)

(a) 23

(b) 33

(c) 45

(d) 57

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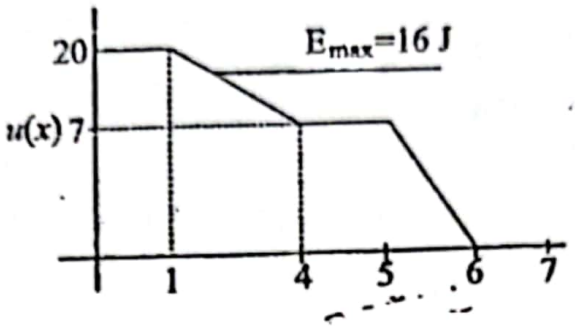
56. A particle of mass 2 kg is moving towards the origin along x with total kinetic energy 16 J. It encounters a region where the potential energy $u(x)$ is shown in the figure. Calculate its velocity when its distance $x = 4.5$ m and the position of turning point



(a) $(-9 \text{ m/s})\,\hat{i}, 2.5$ m

(b) $(-7 \text{ m/s})\,\hat{i}, 3.1$ m

(c) $(-3 \text{ m/s})\,\hat{i}, 1.9$ m

(d) $(-1.5 \text{ m/s})\,\hat{i}, 1.2$ m

57. A 5.0 g bullet moving at 100 m/s strikes a wooden block. Assuming that the bullet undergoes a uniform decelaration and stops after penetrating a distance of 5 cm. The time taken by the bullet to stop and the impulse on the block are respectively

(a) 4.5 ms and 3.2 N-S

(b) 3.5 ms and 2.1 N-S

(c) 2.7 ms and 1.5 N-S

(d) 1.0 ms and 0.5 N-S

58. Calculate the height 'h' above Earth's surface where the acceleration due to gravity would be 2.5 m/s^2
(Given g = 10 m/s^2 and radius of the Earth = R_E)

(a) 0.5 R_E

(b) 1.0 R_E

(c) 1.2 R_E

(d) 1.5 R_E

59. The dimensional formula for pressure gradient of a liquid flowing in a tube is

(a) ML^2T^{-2}

(b) $ML^{-1}T^{-2}$

(c) MLT^{-2}

(d) $ML^{-2}T^{-2}$

60. A 31.4 kg girl wearing high heel shoes balances her weight on a single heel. The diameter of the heel is 1 cm. The pressure (in Pascal) exerted by the heel on the floor is
(Take g = 10 m/s^2)

(a) 2×10^6

(b) 4×10^6

(c) 6×10^6

(d) 8×10^6

61. X-rays of wavelength 0.15 nm on a silicon crystal. The first strong maximum is observed when the X-ray beam makes an angle of 30° with the planes. Calculate the distance between the planes of the silicon crystal

(a) 0.15 nm

(b) 0.30 nm

(c) 0.45 nm

(d) 0.60 nm

62. A transformer operates at $V_p = 9$ kV on the primary side and supplies electrical energy to a number of houses at $V_s = 120$ V (both quantities are rms values). If the total power consumption of the houses is 8 kW, estimate the current (in Amperes) in the primary and secondary of the transformer.

(a) 12 and 800
(b) 9 and 667
(c) 6 and 525
(d) 3 and 450

63. A 5 mole bubble of Helium gas (monoatomic) is submerged to a certain depth in water which undergoes an increase of 10 °C in its temperature. How much energy is added to the Helium bubble as heat during the increase in its temperature and its consequent expansion? (Take R = 8.31 J/mole-K)

(a) 625 J
(b) 1040 J
(c) 1250 J
(d) 2325 J

64. The Earth's electric field 150 N/C (directed downward) acts on the electrons knocked out from the air molecules by the incoming cosmic rays. The work done (in Joules) in lifting an electron 500 meter upward from Earth's surface is (Electric charge on an electron $\cong 1.6\times10^{-19}$ Coulombs)

(a) 3.0×10^{-14}
(b) 1.8×10^{-14}
(c) 1.5×10^{-14}
(d) 1.2×10^{-14}

65. An illuminated slide is held 50 cm from a screen. How far from the slide a lens of focal length 10 cm be placed (between the slide and screen) to form an image of the slide on screen?

(a) 25 cm
(b) 21.3 cm
(c) 13.5 cm
(d) 8.2 cm

66. A block of density $\rho = 800$ kg/m^3 floats face down in a liquid of density 1200 kg/m^3. The block is 6 cm high. Calculate the depth 'h' of the block submerged in the liquid

(a) 2.5 cm

(b) 4.0 cm

(c) 5.0 cm

(d) 5.5 cm

67. Calculate the energy released during the alpha decay of $^{238}_{92}U$. Given the following data :

$^{238}_{92}U = 238.05079$ u

$^{234}_{90}Th = 234.04363$ u

$^{4}_{2}He = 4.00260$ u

1 u = 931.5 MeV

(a) 4.25 MeV

(b) 3.75 MeV

(c) 3.50 MeV

(d) 2.75 MeV

68. In an *n*-type semiconductor which of the following statement is true

(i) Electrons are majority carriers and trivalent atoms are the dopends

(ii) Electrons are minority carriers and pentavalent atoms are the dopends

(iii) Holes are minority carriers and pentavalent atoms are the dopends

(iv) Holes are majority carriers and trivalent atoms are the dopends

(a) (i)

(b) (i) and (ii)

(c) (iii)

(d) (ii) and (iv)

69. A sinusoidal wave travels along a string. The time for a particular point of the string to move from maximum displacement to zero is 0.125 seconds. Calculate the time period and speed of the wave respectively if its wavelength is 1.4 m

(a) 0.5 s and 2.8 m/s
(b) 1.0 s and 1.4 m/s
(c) 1.5 s and 2.8 m/s
(d) 2.0 s and 1.4 m/s

70. A point source of light is 1.2 m below the surface of water. Estimate the diameter of the circle at the surface through which light emerges from the water (Given the refractive index of water to be 1.3)

(a) 2.8 m
(b) 3.5 m
(c) 4.2 m
(d) 4.5 m

71. Two sinusoidal waves of equal amplitude Y_m and wavelength λ travel in opposite direction along a stretched string to produce standing waves. The third antinode is located at a distance from one end is

(a) $3/2\,\lambda$
(b) $5/4\,\lambda$
(c) $7/2\,\lambda$
(d) $3\,\lambda$

72. In a photoelectric experiment with a certain monochromatic light a reverse 1.25 V potential is required to reduce the current to zero. Calculate the maximum speed of the photoelectrons (Given mass of the electron $=9\times10^{-31}$ kg, charge of electron $= 1.6\times10^{-19}$C)

(a) 6.6×10^{5} m/s
(b) 5.75×10^{5} m/s
(c) 5.15×10^{5} m/s
(d) 4.85×10^{5} m/s

73. The energy of electron in quantum state 'n' in Hydrogen atom is given by the relation $E_n = -\frac{hCR}{n^2}$. If the ground state energy is –13.6 eV then the energy of electron in the second excited state is

(a) – 6.8 eV

(b) – 4.5 eV

(c) – 3.4 eV

(d) – 1.5 eV

74. The kinetic energy of a given electron is five times more than a certain proton. How much the de-Broglie's wavelength of electron is bigger than the corresponding wavelength of the proton (Assume that both particles are non-relativistic and $m_p = 2000\ m_e$)

(a) 10

(b) 20

(c) 30

(d) 40

75. A Carnot engine has an efficiency of only 15%. If it operates between constant temperature reservoirs differing in temperatures by 55 °C the temperature of higher temperature reservoir is

(a) 367 °K

(b) 382 °K

(c) 418 °K

(d) 421 °K

76. Tritium's half-life is 12.5 years for beta decay. What fraction of pure Tritium would remain undecayed after 50 years?

(a) 1/4

(b) 1/8

(c) 1/16

(d) 1/24

77. The diffraction pattern of the 633 nm laser light through a single straight slit is observed on a screen 6 m away. The distance between the centres of the first minima outside the central bright fringe is 32 mm. The width of the slit is

(a) 0.85 mm

(b) 0.75 mm

(c) 0.45 mm

(d) 0.24 mm

78. The wavelength of Helium-neon laser in air is 585 nm. As it enters the eye its wavelength changes to 450 nm. Calculate the velocity of the laser light inside the eyeball

(a) 2.1×10^8 m/s

(b) 2.3×10^8 m/s

(c) 2.5×10^8 m/s

(d) 2.8×10^8 m/s

79. A circular coil of radius 10 cm, 500 turns of wire of total resistance 2 Ω is placed with its plane perpendicular to the horizontal component of the Earth's magnetic field. It is rotated about its vertical diameter by 180° in 0.25 seconds. Estimate the induced e.m.f. in the coil (Given the horizontal component of Earth's field = 3×10^{-5} T)

(a) 4×10^{-3} V

(b) 6×10^{-3} V

(c) 8×10^{-3} V

(d) 10×10^{-3} V

80. You are given a thin diverging lens of 20 cm focal length. Calculate the distance at which an object should be placed to obtain 1/3 lateral magnification

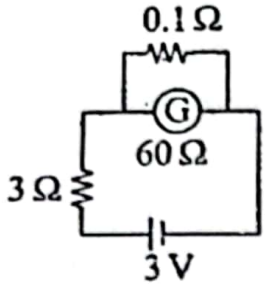
(a) 10 cm

(b) 30 cm

(c) 40 cm

(d) 50 cm

81. The value of current (in Amperes) through the 3 Ω resistance in the circuit as shown is



(a) 0.05 A
(b) 0.25 A
(c) 0.76 A
(d) 0.96 A

82. A 100 V power supply is used to charge a 2.5 μF capacitor which is then connected to a 10 mH inductor. The frequency of the oscillating LC circuit is

(a) 3.14 ms
(b) 2.50 ms
(c) 1.25 ms
(d) 1.00 ms

83. The resistance of the platinum wire of the platinum resistance thermometer at ice point is 5 Ω and at steam point is 5.25 Ω. This thermometer is inserted in a hot liquid then its resistance is 5.75 Ω. Calculate the temperature of the hot liquid (in °C)

(a) 300
(b) 250
(c) 200
(d) 150

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84. A 3.6 A current flows through the headlights of a car. The total charge (in Coulombs) flowed through the lights in 3 hours is nearly

(a) 4×10^4

(b) 3.6×10^4

(c) 5.2×10^4

(d) 6.4×10^4

85. A 12 volts battery with 1 Ω internal resistance is connected to a 5 Ω external resistance. The rate of dissipation of electrical energy in the battery and the rate of conversion of internal chemical energy to electrical energy (in Watts) is

(a) 10, 12

(b) 8, 16

(c) 6, 20

(d) 4, 24

86. Protons (charge $+e$, mass m) are being accelerated in a cyclotron where a magnetic field $\vec{B}$ is applied perpendicular to the dees and a battery of V volts is connected across the dees to accelerate the protons. The number of revolutions per second (frequency in Hz) by the protons is

(a) $eV/2\pi m$

(b) $eB/2\pi m$

(c) $em/2\pi B$

(d) $em/2\pi V$

87. A cube of side length 1 m encloses +26.55 nC charge. The net electric flux (in $N\text{-}m^2/C$) through anyone face of the cube is (Given $\epsilon_0 = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$)

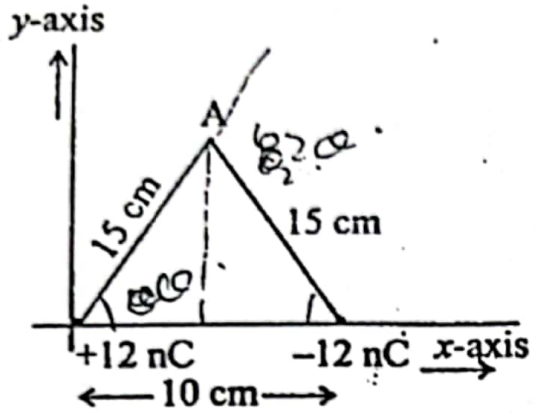
(a) 300

(b) 400

(c) 500

(d) 600

88. Two equal and opposite charges 12 nC are placed 10 cm apart on the x-axis as shown in the figure. Calculate the net electric field at 'A' equidistance (15 cm) from the charges as shown (in proper SI units)



(a) 1.5×10^3

(b) 3.2×10^3

(c) 6.4×10^3

(d) 8.3×10^3

89. Two protons and an alpha particle respectively are held at the corners of an equilateral triangle with side length 8×10^{-10} m. The particles are released and move apart. Their total energy when they are far apart is

(Given : charge on a proton = 1.6×10^{-19} C and $\frac{1}{4\pi \epsilon_0} = 9 \times 10^{+9}$ N-m^2/C)

(a) 4.8×10^{-18} J

(b) 1.6×10^{-18} J

(c) 3.2×10^{-18} J

(d) 1.44×10^{-18} J

101. Let α and β be the roots of the quadratic equation

$x^2 \sin\theta - x(\sin\theta\cos\theta + 1) + \cos\theta = 0$

$\left(0 < \theta < \frac{\pi}{4}\right)$ and $\alpha < \beta$.

Then $\sum_{n=0}^{\infty}\left(\alpha^n + \frac{(-1)^n}{\beta^n}\right)$ is equal to

(a) $\frac{1}{1-\cos\theta} + \frac{1}{1+\sin\theta}$

(b) $\frac{1}{1+\cos\theta} + \frac{1}{1-\sin\theta}$

(c) $\frac{1}{1-\cos\theta} - \frac{1}{1+\sin\theta}$

(d) $\frac{1}{1+\cos\theta} - \frac{1}{1-\sin\theta}$

102. If a line $y = 3x + 1$ cuts the parabola $x^2 - 4x - 4y + 20 = 0$ at A and B, then the tangent of the angle subtended by line segment AB at origin is

(a) $\frac{8\sqrt{3}}{205}$

(b) $\frac{8\sqrt{3}}{209}$

(c) $\frac{8\sqrt{3}}{215}$

(d) None of these

103. If a, b and c be three distinct real numbers in G.P. and $a + b + c = X\,b$, then X cannot be

(a) 4

(b) –3

(c) –2

(d) 2

104. The number of three-digit numbers of the form xyz such that $x < y$ and $z \leq y$ is

(a) 276

(b) 285

(c) 240

(d) 244

105. A circle touches the x-axis and also touches the circle with centre (0, 3) and radius 2. The locus of the centre of the circle is

(a) a circle

(b) an ellipse

(c) a parabola

(d) a hyperbola

106. If 19^{th} term of a nonzero A.P. is zero, then its (49^{th} term) : (29^{th} term) is

(a) 3:1

(b) 4:1

(c) 2:1

(d) 1:3

107. The locus of centre of the circle touching the line $2x - y = 1$ at (1, 1) is

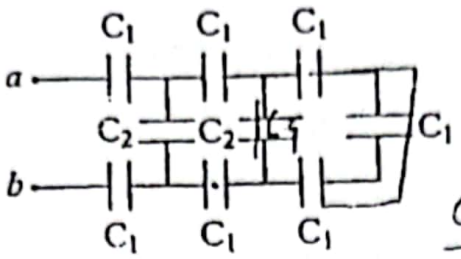
(a) $x + 3y = 2$

(b) $x + 2y = 0$

(c) $x + y = 2$

(d) $2x - y = 1$

90. In the figure shown, each capacitor C_1 is 6.9 μF and C_2 is 4.6 μF. Calculate the equivalent capacitance between points '*a*' and '*b*'



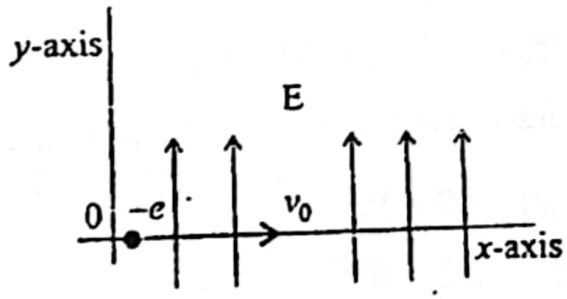
(a) 48.3 μF

(b) 9.2 μF

(c) 11.5 μF

(d) 2.3 μF

91. An electron (mass *m* and charge $-e$) is fired along *x*-axis with a velocity $\bar{v}_0$ in an area with uniform electric field $\bar{E}$ along *y*-axis as shown in the figure. The trajectory of the electron is given by the relation



(a) $y = -\dfrac{2eE}{mv_0}x^2$

(b) $y = -\dfrac{1}{2}\dfrac{eE}{mv_0^2}x^2$

(c) $y = -\dfrac{2eE^2}{mv_0^2}x$

(d) $y = -\dfrac{1}{2}\dfrac{(eE)^2}{mv_0^2}x$

92. An Earth's satellite is moving with a linear velocity v. Its altitude 'h' is given by the following relation (Given Mass of Earth = M_E, Radius of Earth = R_E)

(a) $h = \frac{GR_E}{M_E} - R_E$

(b) $h = \frac{GM_E}{v} - \frac{v}{R_E}$

(c) $h = \frac{GM_E}{v^2} - R_E$

(d) $h = \frac{GR_E}{v^2} - \frac{vM_E}{R_E}$

93. An ambulance producing siren with frequency 300 Hz is moving in the positive x-axis direction with velocity 45 m/s. Calculate the apparent frequency to a listener moving also in the positive x-axis direction with speed 15 m/s.

(a) 277 Hz

(b) 330 Hz

(c) 315 Hz

(d) 345 Hz

94. The number of moles in 1 kg water is

(a) 18.0

(b) 25.7

(c) 32.5

(d) 55.6

95. A steam engine delivers 5.4×10^8 J of work per minute and absorbs 3.6×10^9 J of heat per minute from the boiler of the engine. Calculate the efficiency of the engine

(a) 30%

(b) 25%

(c) 20%

(d) 15%

96. Two monoatomic gases are kept in a container at room temperature. Their mass numbers are 36 and 25 respectively. Calculate the percentage difference in their rms speeds

(a) 40%

(b) 30%

(c) 20%

(d) 10%

97. A body is executing SHM according to the relation (in S.I. units)

$x = 5\sqrt{2} \cos(2\pi t + \pi/4)$

Its acceleration at $t = 1$ seconds is nearly

(a) 200 m/s^2

(b) 175 m/s^2

(c) 150 m/s^2

(d) 100 m/s^2

98. The gauge pressure produced by a machine to suck mud of density 1800 kg/r up a tube by a height of 2.0 m from ground is
(Take $g = 9.8$ m/s^2)

(a) 2.0×10^4 Pa

(b) 3.5×10^4 Pa

(c) 6.2×10^4 Pa

(d) 9.8×10^4 Pa

99. An anchor of a ship, made of iron with density 7870 kg/m^3 appears 210 lighter in water. Calculate the volume of anchor and its weight in air
(Take $g = 9.8$ m/s^2)

(a) 1.78×10^{-2} m^3; 2.10 KN

(b) 2.14×10^{-2} m^3; 1.65 KN

(c) 5.87×10^{-2} m^3; 3.75 KN

(d) 7.87×10^{-2} m^3; 5.67 KN

100. The coefficient of volume expansion of glycerin is 49×10^{-5} K^{-1}. Calculate th fractional change in its density for a 30 °C rise in its temperature

(a) 4.9×10^{-2}

(b) 3.2×10^{-2}

(c) 1.5×10^{-2}

(d) 0.8×10^{-2}

108. The positive value of λ for which the coefficient of x^2 in the expression $x^2\left(\sqrt{x}+\frac{\lambda}{x^2}\right)^{10}$ is 720 is

(a) $\sqrt{5}$

(b) 4

(c) $2\sqrt{2}$

(d) 3

109. ABCD is a square of unit area. A circle is tangent to two sides of ABCD and passes through exactly one of its vertices. The radius of the circle is

(a) $2-\sqrt{2}$

(b) $\sqrt{2}-1$

(c) $\frac{1}{2}$

(d) $\frac{1}{\sqrt{2}}$

110. If $a, b, c \in \mathbb{R}^+$, such that $a+b+c=18$, then the maximum value of $a^2b^3c^4$ is equal to

(a) $2^{18}\times 3^2$

(b) $2^{18}\times 3^3$

(c) $2^{19}\times 3^2$

(d) $2^{19}\times 3^3$

111. The equation of the plane bisecting the acute angle between the planes $2x-y+2z+3=0$ and $3x-2y+6z+8=0$ is

(a) $23x-13y+32z+45=0$

(b) $5x-y-4z=3$

(c) $5x-y-4z+45=0$

(d) $23x-13y+32z+3=0$

112. If the third term in the binomial expression of $(1+X^{\log_2 X})^5$ equals 2560, then possible value of X is

(a) $2\sqrt{2}$

(b) $\frac{1}{8}$

(c) $4\sqrt{2}$

(d) $\frac{1}{4}$

113. If the straight lines $2x+3y-1=0$, $x+2y-1=0$ and $ax+by-1=0$ form triangle with origin as orthocentre, then (a, b) is given by

(a) (6, 4)

(b) (–3, 3)

(c) (–8, 8)

(d) (0, 7)

114. For $x^2-(a+3)|x|+4=0$ to have real solutions, the range of a is

(a) $(-\infty,-7]\cup[1,\infty)$

(b) $(-3,\infty)$

(c) $(-\infty,-7]$

(d) $[1,\infty)$

115. The line $2x+y=1$ touches a hyperbola and passes through the point of intersection of a directrix and the x-axis. The equation of hyperbola is

(a) $\frac{x^2}{1}-\frac{y^2}{3}=1$

(b) $\frac{x^2}{1}-\frac{y^2}{3}=2$

(c) $\frac{x^2}{3}-\frac{y^2}{1}=1$

(d) $\frac{x^2}{3}-\frac{y^2}{1}=2$

116. Let $A=\{x_1,x_2,x_3,\ldots,x_7\}$, $B=\{y_1,y_2,y_3\}$. The total number of functions $f:A\to B$ that are onto and there are exactly three elements x in A such that $f(x)=y_2$ is equal to

(a) 490

(b) 510

(c) 630

(d) None of these

117. If the intercepts made on the line $y=mx$ by lines $y=2$ and $y=6$ is less than 5, then the range of values of m is

(a) $(-\infty,-4/3)\cup(4/3,\infty)$

(b) $(-4/3,\ 4/3)$

(c) $(-3/4,\ 4/3)$

(d) none of these

118. If the maximum value of $y=a\cos x-\frac{1}{3}\cos 3x$ occurs when $x=\frac{\pi}{6}$, then the value of a is

(a) -2

(b) 2

(c) $\frac{2}{\sqrt{3}}$

(d) $-\frac{2}{\sqrt{3}}$

119. The number of points in the rectangle $\{(x,y): -12 \le x \le 12$ and $-3 \le y \le 3$ which lie on the curve $y = x + \sin x$ and at which the tangent to the curve parallel to the x-axis is

(a) 0

(b) 2

(c) 4

(d) 8

120. The last digit of $(1! + 2! + 3! + ... + 2005!)^{502}$ is

(a) 9

(b) 2

(c) 7

(d) 1

121. The area bounded by the circle $x^2 + y^2 = 8$, the parabola $x^2 = 2y$ and the li $y = x$ in $y \ge 0$ is

(a) $\frac{2}{3} + 2\pi$

(b) $\frac{2}{3} - 2\pi$

(c) $\frac{2}{3} + \pi$

(d) $\frac{2}{3} - \pi$

122. The constraints

$$-x_1 + x_2 \le 1$$
$$-x_1 + 3x_2 \le 9$$
$$x_1, x_2 \ge 0$$

defines on

(a) Bounded feasible space

(b) Unbounded feasible space

(c) Both bounded and unbounded feasible space

(d) None of these

123. If α is a real number, then the value of $\int \frac{dx}{\cos x\sqrt{\sin(2x+\alpha)+\sin\alpha}}$ is

(a) $\sqrt{(\tan x+\tan\alpha)}+C$; where C is an arbitrary constant

(b) $\sqrt{2(\tan x+\tan\alpha)}+C$; where C is an arbitrary constant

(c) $\sqrt{\frac{2(\tan x+\tan\alpha)}{\sin\alpha}}+C$; where C is an arbitrary constant

(d) $\sqrt{\frac{2(\tan x+\tan\alpha)}{\cos\alpha}}+C$; where C is an arbitrary constant

124. The value of $\int_0^a \frac{a\,dx}{\left\{x+\sqrt{(a^2-x^2)}\right\}^2}$ is

(a) $\log(\sqrt{2}+1)$

(b) $\frac{1}{\sqrt{2}}\log(\sqrt{2}+1)$

(c) $\sqrt{2}\log(\sqrt{2}-1)$

(d) $\frac{1}{\sqrt{2}}\log(\sqrt{2}-1)$

125. A bag contains 30 white balls and 10 red balls. 16 balls are drawn one-by-one randomly from the bag with replacement. If X be the number of white balls drawn, then $\left(\frac{\text{mean X}}{\text{standard deviation of X}}\right)$ is equal to

(a) 4

(b) $\frac{4\sqrt{3}}{3}$

(c) $4\sqrt{3}$

(d) $3\sqrt{2}$

126. The value of $\int_0^{\pi} \frac{x \sin x}{1+\sin x} dx$ is

(a) $\pi\left(\frac{\pi}{2}-1\right)$

(b) $\pi\left(\frac{\pi}{2}+1\right)$

(c) $\pi\left(\frac{\pi}{3}-1\right)$

(d) $\pi\left(\frac{\pi}{3}+1\right)$

127. If the probability of hitting a target by a shooter in any shot, is 1/3, then the minimum number of independent shots at the target required by him so that the probability of hitting the target at least once is greater than 5/6, is

(a) 6

(b) 5

(c) 4

(d) 3

128. The solution of the differential equation $\frac{dy}{dx}+y\cos x=\frac{\sin 2x}{2}$, is

(a) $ye^{\sin x}=C+e^{2\sin x}(\sin x-1)$

(b) $ye^{\sin x}=C+e^{\sin x}(\sin x-1)$

(c) $ye^{\sin x}=C+e^{-\sin x}(\sin x+1)$

(d) $ye^{\sin x}=C+e^{-2\sin x}(\sin x-1)$; C being an arbitrary constant

129. A data consists of n observations $x_1, x_2, \ldots, x_n$. If $\sum_{i=1}^{n}(x_i+1)^2 = 9n$ and $\sum_{i=1}^{n}(x_i-1)^2 = 5n$, then the standard deviation of this data is

(a) 5

(b) $\sqrt{5}$

(c) $\sqrt{7}$

(d) 2

130. The order and the degree of the differential equation of the family of all circles of radius c, where c is fixed, are respectively

(a) 2, 1

(b) 2, 3

(c) 2, 2

(d) 3, 3

131. Let $d \in \mathbb{R}$, and

$$A = \begin{bmatrix} -2 & 4+d & \sin\theta - 2 \\ 1 & \sin\theta + 2 & d \\ 5 & 2\sin\theta - d & -\sin\theta + 2 + 2d \end{bmatrix}$$

$\theta \in [0, 2\pi]$. If minimum value of $\det(A) = 8$, then a value of d is

(a) -7

(b) $2(\sqrt{2}+2)$

(c) -5

(d) $2(\sqrt{2}+1)$

132. The values of a, b and c which make the function

$$f(x)=\begin{cases}\dfrac{\sin(a+1)x+\sin x}{x}, & x<0\\ c & x=0\\ \dfrac{\sqrt{x+bx^2}-\sqrt{x}}{bx^{3/2}} & x>0\end{cases}$$

continuous at $x=0$ are

(a) $a=\dfrac{-3}{2}, b=0, c=1/2$

(b) $a=\dfrac{3}{2}, b\neq 0, c=1/2$

(c) $a=\dfrac{-3}{2}, b\neq 0, c=1/2$

(d) None of these

133. Let $A=\begin{bmatrix}2 & b & 1\\ b & b^2+1 & b\\ 1 & b & 2\end{bmatrix}$ where $b>0$. Then the minimum value of $\dfrac{\det(A)}{b}$ is

(a) $\sqrt{3}$

(b) $-\sqrt{3}$

(c) $-2\sqrt{3}$

(d) $2\sqrt{3}$

134. The function

$f(x)=x-|x-x^2|, -1\le x\le 1$

is continuous on the interval

(a) $[-1, 1]$

(b) $(-1, 1)$

(c) $[-1, 1]\setminus\{0\}$

(d) $(-1, 1)\setminus\{0\}$

135. The value of

$$\cot\left[\sum_{n=1}^{19}\cot^{-1}\left(1+\sum_{p=1}^{n}2p\right)\right] \text{ is}$$

(a) $\frac{22}{23}$

(b) $\frac{23}{22}$

(c) $\frac{21}{19}$

(d) $\frac{19}{21}$

136. A plane which is pairing through the point (3, 2, 0) and the line $\frac{x-3}{1}=\frac{y-6}{5}=\frac{z-4}{4}$ is

(a) $x-y+z=1$

(b) $x+y+z=1$

(c) $x-y+2z=0$

(d) $x+y+2z=0$

137. Let $f(x+y)=f(x)f(y)$ for all x, y, where $f(0)\neq 0$. If $f'(0)=2$, then $f(x)$ is equal to

(a) Ae^x

(b) Ae^{2x}

(c) $2x$

(d) $2Ax$

138. If the vectors $a\hat{i}+\hat{j}+\hat{k}$, $\hat{i}+b\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+c\hat{k}(a\neq b\neq c\neq 1)$ are coplanar, then the value of $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$ is

(a) -1

(b) 1

(c) $-\frac{1}{2}$

(d) $\frac{1}{2}$

139. If $f(x)=\sum_{n=0}^{\infty}\frac{x^n}{n!}(\log a)^n$, then at $x=0, f(x)$

(a) has no limit

(b) is discontinuous

(c) is continuous but not differentiable

(d) is differentiable

140. The vector projection of a vector $\hat{i}+\hat{k}$ on y-axis is

(a) 1

(b) 2

(c) 0

(d) $\sqrt{3}$

141. Locus of the point of intersection of the tangent at the end points of the foc chord of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, $(b<a)$ is a/an

(a) circle

(b) ellipse

(c) hyperbola

(d) pair of straight line

142. If $f(x) = \min\left(|x|, 1-\lfloor x \rfloor, \frac{1}{4}\right)$, $\forall x \in \mathbb{R}$, then the value of $\int_{-1}^{1} f(x)dx$ is

(a) 0

(b) $\frac{1}{8}$

(c) $\frac{3}{8}$

(d) 1

143. A perpendicular is drawn from a point (1, 6, 3) to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

The coordinates of the foot of perpendicular is

(a) (1, 3, 5)

(b) (0, 3, –2)

(c) (2, 4, –5)

(d) (1, 3, 4)

144. Which of the following statements is always true?

(a) If $f(x)$ is increasing, then $f^{-1}(x)$ is decreasing

(b) If $f(x)$ is decreasing, then $\frac{1}{f(x)}$ is also increasing

(c) If f and g are positive function and f is increasing and g is decreasing, then $\frac{f}{g}$ is a decreasing function

(d) If f and g are positive function and f is decreasing and g is increasing, then $\frac{f}{g}$ is a decreasing function

145. If $0 \le x \le \frac{\pi}{2}$, then the number of values of x for which $\sin x - \sin 2x + \sin 3x = 0$ is

(a) 2

(b) 1

(c) 3

(d) 4

146. If the ellipse $\frac{x^2}{4} + y^2 = 1$ meets the ellipse $x^2 + \frac{y^2}{a^2} = 1$ in four distinct points and $a = b^2 - 5b + 7$, then b does not lie in

(a) $[4, 5]$

(b) $(-\infty, 2) \cup (3, \infty)$

(c) $(-\infty, 0)$

(d) $[2, 3]$

147. If z is a complex number of unit modulus and argument θ, then $\arg\left(\frac{1+z}{1+\bar{z}}\right)$ equals to

(a) $-\theta$

(b) $\frac{\pi}{2} - \theta$

(c) θ

(d) $4 - \theta$

148. Let $f(x) = ax^3 + bx^2 + cx + 1$ have extrema at $x = \alpha, \beta$ such that $\alpha\ \beta < 0$ and $f(\alpha) f(\beta) < 0$. Then the equation $f(x) = 0$ has

(a) three equal roots

(b) one negative root if $f(\alpha) < 0$ and $f(\beta) > 0$

(c) one positive root if $f(\alpha) > 0$ and $f(\beta) < 0$

(d) None of these

149. Let S and S′ be two foci of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. If a circle described on SS′ as diameter intersects the ellipse in real and distinct points, then the eccentricity e of the ellipse satisfies

(a) $\frac{1}{\sqrt{2}}$

(b) $e\in\left(\frac{1}{\sqrt{2}},1\right)$

(c) $e\in\left(0,\frac{1}{\sqrt{2}}\right)$

(d) None of these

150. If the system of linear equations

$$x-4y+7z=g$$
$$3y-5z=h$$
$$-2x+5y-9z=k$$

is consistent, then

(a) $g+h+k=0$

(b) $2g+h+k=0$

(c) $g+h+2k=0$

(d) $g+2h+k=0$

The candidate is required to fold at the perforation and tear it off after the Admission Test

ALIGARH MUSLIM UNIVERSITY

SERIES D

Admission Test-Answer Sheet

PLEASE READ THE INSTRUCTIONS PROVIDED ON THE BACK OF THE OMR ANSWER SHEET BEFORE FILLING

1. NAME OF THE CANDIDATE

2. FOR CANDIDATE ONLY

Signature with date

FOR INVIGILATOR ONLY

CANDIDATE'S ROLL NUMBER

ROOM NO.....

BAR CODE

1521957

6. QUESTION BOOKLET NUMBER

3. ROLL NUMBER

4. APPLICATION NO.

7. CENTRE CODE

8. QUESTION PAPER SERIES

A B C D

Certified that the entries and bubble have been filled / shaded correctly.

Signature with date
(Do not Sign out of this box)

5. Gender (Male/Female/Other)

Male M
Female F
Other O

9. Status (Internal / External)

Internal I
External E

ANSWER SECTION

1	A B C D	41	A B C D	81	A B C D	121	A B C D	161	A B C D
2	A B C D	42	A B C D	82	A B C D	122	A B C D	162	A B C D
3	A B C D	43	A B C D	83	A B C D	123	A B C D	163	A B C D
4	A B C D	44	A B C D	84	A B C D	124	A B C D	164	A B C D
5	A B C D	45	A B C D	85	A B C D	125	A B C D	165	A B C D
6	A B C D	46	A B C D	86	A B C D	126	A B C D	166	A B C D
7	A B C D	47	A B C D	87	A B C D	127	A B C D	167	A B C D
8	A B C D	48	A B C D	88	A B C D	128	A B C D	168	A B C D
9	A B C D	49	A B C D	89	A B C D	129	A B C D	169	A B C D
10	A B C D	50	A B C D	90	A B C D	130	A B C D	170	A B C D
11	A B C D	51	A B C D	91	A B C D	131	A B C D	171	A B C D
12	A B C D	52	A B C D	92	A B C D	132	A B C D	172	A B C D
13	A B C D	53	A B C D	93	A B C D	133	A B C D	173	A B C D
14	A B C D	54	A B C D	94	A B C D	134	A B C D	174	A B C D
15	A B C D	55	A B C D	95	A B C D	135	A B C D	175	A B C D
16	A B C D	56	A B C D	96	A B C D	136	A B C D	176	A B C D
17	A B C D	57	A B C D	97	A B C D	137	A B C D	177	A B C D
18	A B C D	58	A B C D	98	A B C D	138	A B C D	178	A B C D
19	A B C D	59	A B C D	99	A B C D	139	A B C D	179	A B C D
20	A B C D	60	A B C D	100	A B C D	140	A B C D	180	A B C D
21	A B C D	61	A B C D	101	A B C D	141	A B C D	181	A B C D
22	A B C D	62	A B C D	102	A B C D	142	A B C D	182	A B C D
23	A B C D	63	A B C D	103	A B C D	143	A B C D	183	A B C D
24	A B C D	64	A B C D	104	A B C D	144	A B C D	184	A B C D
25	A B C D	65	A B C D	105	A B C D	145	A B C D	185	A B C D
26	A B C D	66	A B C D	106	A B C D	146	A B C D	186	A B C D
27	A B C D	67	A B C D	107	A B C D	147	A B C D	187	A B C D
28	A B C D	68	A B C D	108	A B C D	148	A B C D	188	A B C D
29	A B C D	69	A B C D	109	A B C D	149	A B C D	189	A B C D
30	A B C D	70	A B C D	110	A B C D	150	A B C D	190	A B C D
31	A B C D	71	A B C D	111	A B C D	151	A B C D	191	A B C D
32	A B C D	72	A B C D	112	A B C D	152	A B C D	192	A B C D
33	A B C D	73	A B C D	113	A B C D	153	A B C D	193	A B C D
34	A B C D	74	A B C D	114	A B C D	154	A B C D	194	A B C D
35	A B C D	75	A B C D	115	A B C D	155	A B C D	195	A B C D
36	A B C D	76	A B C D	116	A B C D	156	A B C D	196	A B C D
37	A B C D	77	A B C D	117	A B C D	157	A B C D	197	A B C D
38	A B C D	78	A B C D	118	A B C D	158	A B C D	198	A B C D
39	A B C D	79	A B C D	119	A B C D	159	A B C D	199	A B C D
40	A B C D	80	A B C D	120	A B C D	160	A B C D	200	A B C D