1. Three isolated metal spheres A, B, C have radius R, 2R, 3R respectively, and same charge Q. U_A, U_B and U_C be the energy density just outside the surface of the spheres. The relation between U_A, U_B and U_C is
(A) $U_A > U_B < U_C$ (B) $U_A \geq U_B \geq U_C$ (C)

2. In an adiabatic expansion of a gas initial and final temperatures are T_1 and T_2 respectively then the change in internal energy of the gas is [R = gas constant, γ = adiabatic ratio]
(A) $R(T_1 - T_2)$ (B) $\frac{R}{\gamma - 1}(T_1 - T_2)$
(C) $\frac{R}{\gamma - 1}(T_2 - T_1)$ (D) zero

3. In which thermodynamic process, there is no exchange of heat between the system and surroundings?
(A) Isothermal (B) Adiabatic
(C) Isochoric (D) Isobaric

4. A hollow cylinder has a charge q coulomb within it. It ϕ is the electric flux associated with the curved surface B, the flux linked with the plane surface A will be

C B A

(A) $\frac{\phi}{3}$ (B) $\frac{q}{\epsilon_0} - \phi$
(C) $\frac{1}{2}\left(\frac{q}{\epsilon_0} - \phi\right)$ (D) $\frac{q}{2\epsilon_0}$

5. The output Y when all the three inputs A, B, C are first low and then high will be respectively

A
B
C
———
Y

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

6. In metre bridge experiment, null point is obtained at 20 cm from left end of the wire, when resistance X is balanced against another resistance Y (X < Y). To balance a resistance 4 X against Y, the new position of the null point from the same end will be
(A) 80 cm (B) 60 cm
(C) 40 cm (D) 50 cm

7. The work done by a force on body of mass 5 kg to accelerate it in the direction of force from rest to 20 m/s^2 in 10 second is
(A) 2×10^3 J (B) 4×10^3 J
(C) 10^{-3} J (D) 10^3 J

8. A diffraction pattern is obtained by making blue light incident on a narrow slit. If blue light is replaced by red light then
(A) there is no change in diffraction pattern.
(B) diffraction bands become broader.
(C) diffraction bands disappear.
(D) diffraction bands become narrower.

9. In a p-type semiconductor,
(A) electrons are minority carriers and pentavalent atoms are dopants.
(B) electrons are majority carries and pentavalent atoms are dopants.
(C) holes are majority carriers and trivalent atoms are dopants.
(D) holes are minority carriers and trivalent atoms are dopants.

10. Two thin lenses have a combined power of + 9D. When they are separated by a distance of 20 cm, then their equivalent power becomes $+\frac{27}{5}$ D. Their individual power (in dioptre) is respectively
(A) 3, 6 (B) 1, 8
(C) 2, 7 (D) 4, 5

11. In hydrogen atom, radius of the smallest orbit of the elctron is a_0, the radius of the third orbit is
(A) $9\,a_0$ (B) $\frac{a_0}{9}$
(C) $3\,a_0$ (D) $6\,a_0$

12. Which one of the following statements is 'NOT' true about the angle of contant of a liquid?
(A) Any increase in the temperature of the liquid does not decrease its angle of contact.
(B) Angle of contact depends upon the nature of liquid and solid in contact.
(C) If an impurity is added in the liquid then it's angle of contact changes.
(D) At a given temperature, the angle of contact is constant for a solid-liquid surface.

13. Two coils P and S have a mutual inductance of 3×10^{-3} H. If the current in the coil, P is $I = 20 \sin (50 \pi t)$, then the maximum value of the e.m.f. induced in coil S is
(A) 6.28 V (B) 12.56 V
(C) 15.70 V (D) 3.14 V

14. A metal wire of density 'ρ' floats on water surface horizontally. If it is NOT to sink in water, then maximum radius of wire is
(T = surface tension of water, g = gravitational acceleration)
(A) $\sqrt{\frac{\pi\rho g}{T}}$ (B) $\frac{T}{\pi\rho g}$
(C) $\frac{\pi\rho g}{T}$ (D) $\sqrt{\frac{2T}{\pi\rho g}}$

15. A mass tied to a string is whirled in a horizontal circular path with a constant angular velocity and its angular momentum is L. If the string is now halved, keeping angular velocity same, then the angular momentum will be
(A) L (B) $\frac{L}{4}$
(C) 2L (D) $\frac{L}{2}$

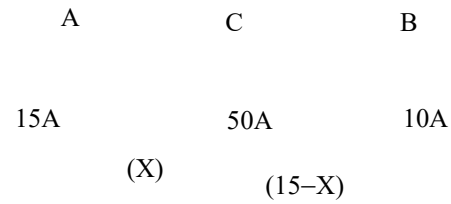
16. A galvanometer of resistance G has voltage range V_g. Resistance required to convert it to read voltage up to V is
(A) $\left(\frac{V - V_g}{V}\right).G$ (B) $G \cdot \left(\frac{V}{V - V_g}\right)$
(C) $\frac{G \cdot V_g}{V}$ (D) $\left(\frac{V + V_g}{V}\right)G$

17. In LCR series resonance circuit, choose the wrong statement.
(A) Resonance occurs at $X_L = X_C$.
(B) At resonance, current has a maximum value.
(C) At resonance, circuit is purely inductive.
(D) At resonance, impedance is minimum.

18. An electron jumps from the 4th orbit to the 2nd orbit of hydrogen atom. Given the Rydberg's constant $R = 10^7 m^{-1}$. The frequency in Hz of the emitted radiation is ($c = 3 \times 10^8$ m/s)
(A) $\frac{9}{16} \times 10^{15}$ (B) $\frac{3}{16} \times 10^5$
(C) $\frac{3}{16} \times 10^{15}$ (D) $\frac{9}{16} \times 10^5$

19. Two point charges q_1 and q_2 are 'l' distanceapart. If one of the charges is doubled and distance between them is halved, the magnitude of force becomes n times, where n is
(A) 16 (B) 8
(C) 1 (D) 2

20. Three long straight and parallel wires carrying currents are arranged as shown



The wire C which carries a current of 50A is so placed that it experiences no force. The distance of wire C from wire A is
(A) 7 cm (B) 9 cm
(C) 3 cm (D) 5 cm

21. A photon of energy 'E' ejects photoelectrons from a metal surface whose work function is W_0. If this electron enters into uniform magneticfield of induction 'B' in a direction perpendicular to field and describes a circular path of radius 'r', then radius is given by
(A) $\frac{\sqrt{2m(E - W_0)}}{eB}$ (B) $\sqrt{\frac{2e(E - W_0)}{mB}}$
(C) $\sqrt{\frac{2m(E - W_0)}{eB}}$ (D) $\sqrt{2m(E - W_0)eB}$

22. A satellite of mass 'm' is revolving around the earth of mass 'M' in an orbit of radius 'r'. The angular momentum of the satellite about the centre of orbit will be
(A) $\sqrt{GMmr}$ (B) $\sqrt{GMm^2r}$
(C) $\sqrt{mvr}$ (D) $\sqrt{GMm}$

23. The coefficient of linear expansion of brass and steel rod are 'α_1' and 'α_2' respectively. Lengths of brass and steel rods are 'l_1' and 'l_2' respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relation is correct?
(A) $\alpha_1 l_2 = \alpha_2 l_1$ (B) $l_1\alpha_1 = l_2\alpha_2$
(C) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (D) $\alpha_1^2 l_2 = \alpha_2^2 l_1$

24. Consider the following statements about interference of light.
A – When crest of one wave coincides with crest of another wave at a point, this point is a point of destructive interference.
B – Two coherent sources emit wave of same frequency with constant phase difference.
Choose the correct option from the following.
(A) Both statements A and B are wrong.
(B) Statement B is correct while statement A is wrong.
(C) Statement A is correct while statement B is wrong.
(D) Both statements A and B are

25. Two satellites A and B rotate round a planet's orbit having radius 4R and R respectively. If the speed of satellite A is 3 V then speed of satellite B is

(A) $\frac{3V}{2}$ (B) 6V

(C) $\frac{4V}{2}$ (D) 12V

26. An equation of a simple harmonic progressive wave is given by y = A sin (100 πt – 3x). The distance between two particles having a phase difference of $(\pi/3)^c$ in metre is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{18}$

(C) $\frac{\pi}{9}$ (D) $\frac{\pi}{6}$

27. A wall is hit elastically and normally by 'n' balls per second. All the balls have the same mass 'm' and are moving with the same velocity 'u'. the force exerted by the balls on the wall is

(A) 2mnu (B) $\frac{1}{2}mnu^2$

(C) mnu (D) $2mnu^2$

28. A magnetizing field of 1000 A/m produces a magnetic flux of 2.4×10^{-5} Wb in an iron bar of cross-sectional area 0.3 cm^2. The magnetic permeability of the iron bar in SI unit is

(A) 2.5×10^{-4} (B) 8×10^{-4}

(C) 5×10^{-4} (D) 4×10^{-4}

29. For a particular sound wave propagating in air, a path difference between two points is 0.54 m which is equivalent to phase difference of $(1.8\ \pi)^c$. If the velocity of sound wave in air is 330 m/s, the frequency of this wave is

(A) 110 Hz. (B) 367 Hz.

(C) 550 Hz. (D) 660 Hz.

30. To a bird in air, a fish in water appears to be at 30 cm from the surface. If refractive index of water with respect to air is $\frac{4}{3}$, the real distance of bird from the surface is

(A) 30cm (B) 50cm

(C) 40cm (D) 60cm

31. With an alternating voltage source of frequency 'f', inductor 'L', capacitor 'C' and resistance 'R' are connected in series. The voltage leads the current by 45°. The value of 'L' is (tan 45° = 1)

(A) $\left(\frac{1-2\pi fCR}{4\pi^2 f^2 C}\right)$ (B) $\left(\frac{4\pi^2 f^2 C}{1-2\pi fCR}\right)$

(C) $\left(\frac{1+2\pi fCR}{4\pi^2 f^2 C}\right)$ (D) $\left(\frac{4\pi^2 f^2 C}{1+2\pi fCR}\right)$

32. If 'N' is the number of turns in a circular coil, the value of its self-inductance varies as

(A) N^0 (B) N^3

(C) N^2 (D) N^1

33. Four identical condensers are connected in parallel and then in series equivalent capacitance in series to that in parallel combination is

(A) 16 : 1 (B) 4 : 1

(C) 1 : 4 (D) 1 : 16

34. If 'V' is velocity and 'a' is acceleration of a particle executing linear simple harmonic motion. Which one of the following statements is correct?

(A) when 'a' is maximum, v is maximum.

(B) when 'a' is maximum, v is zero.

(C) when 'a' is zero, v is zero.

(D) 'a' is zero for any value of 'v'.

35. For a particle performing S.H.M. the equation $\left(\frac{d^2x}{dt^2}\right) + a\ x = 0$. Then the time period of the motion will be

(A) $2\pi a$ (B) $\frac{2\pi}{\sqrt{\alpha}}$

(C) $\frac{2\pi}{\alpha}$ (D) $2\pi\sqrt{\alpha}$

36. Two spheres 'S_1' and 'S_2' have same radii but temperatures are 'T_1' and 'T_2' respectively. Their emissive power is same and emissivity is in the ratio 1 : 4. Then the ratio 'T_1' to 'T_2' is (A) 1 : 2 (B) 2 : 1

(C) $\sqrt{2}$: 1 (D) 1 : $\sqrt{2}$

37. A photoelectric surface is illuminated successively by monochromatic light of wavelength '(λ)' and '$\left(\frac{\lambda}{2}\right)$'. If the maximum kinetic energy of the emitted photoelectrons in the first case is one-third that in the second case, the work function of the surface of the material is (c = speed of light, h = Planck's constant.)

(A) $\frac{hc}{3\lambda}$ (B) $\frac{hc}{2\lambda}$

(C) $\frac{2hc}{\lambda}$ (D) $\frac{hc}{\lambda}$

38. Air column in two identical tubes is vibrating. Tube A has one end closed and tube B has both ends open. Neglecting end correction, the ratio of the fundamental frequency of air column in tube A to that in tube B is

(A) 2 : 1 (B) 4 : 1

(C) 1 : 4 (D) 1 : 2

39. A string is vibrating in its fifth overtone between two rigid supports 2.4 m apart. The distance between successive node and antinode is

(A) 0.2 m (B) 0.6 m
(C) 0.8 m (D) 0.1 m

40. The maximum speed of a particle in S.H.M. is V. The average speed is

(A) $\frac{3V}{\pi}$ (B) $\frac{4V}{\pi}$
(C) $\frac{V}{\pi}$ (D) $\frac{2V}{\pi}$

41. A liquid drop having surface energy 'E' is spread into 216 droplets of the same size. The final surface energy of the droplets is

(A) 3 E (B) 8 E
(C) 2 E (D) 6 E

42. A light wave of wavelength 'λ' is incident on a slit of width 'd'. The resulting diffraction pattern is observed on a screen at a distance 'D'. If linear width of the principal maximum is equal to the width of the slit, then the distance D is

(A) $\frac{2\lambda^2}{d}$ (B) $\frac{d}{\lambda}$
(C) $\frac{d^2}{2\lambda}$ (D) $\frac{2\lambda}{d}$

43. A transistor is used as a common emitter amplifier with a load resistance 2kΩ. The input resistance is 150Ω. Base current is changed by 20μA which results in a change in collector current by 1.5 mA. The voltage gain of the amplifier is

(A) 1100 (B) 1200
(C) 900 (D) 1000

44. A 4 kg mass and a 1 kg mass are moving with equal energies. The ratio of the magnitude of their linear momenta is

(A) 1 : 2 (B) 2 : 1
(C) 1 : 1 (D) 4 : 1

45. The ratio of the speed of sound in helium gas to that in nitrogen gas at same temperature is ($\gamma_{He} = \frac{5}{3}$, $\gamma_{N2} = \frac{7}{5}$, $M_{He} = 4$, $M_{N_2} = 28$)

(A) $\frac{5}{\sqrt{3}}$ (B) $\sqrt{\frac{7}{5}}$
(C) $\sqrt{\frac{2}{7}}$ (D) $\sqrt{\frac{5}{3}}$

46. A van is moving with a speed of 108 km/hr on a level road where the coefficient of friction between the tyres and the road is 0.5. For the safe driving of the van, the minimum radius of curvature of the road shall be (Acceleration due to gravity, $g = 10\ m/s^2$)

(A) 180 m (B) 120 m
(C) 80 m (D) 40 m

47. Two long parallel wires seperated by distance 'd' carry currents I_1 and I_2 in the same direction. They exert a force F on each other. Now the current in one of the wire is increased to three times and its direction is made opposite. The distance between the wires is doubled. The magnitude of force between them is

(A) $\frac{F}{2}$ (B) $\frac{3F}{2}$ (C) $\frac{2F}{3}$ (D) 3F

48. A metal disc of radius 'R' rotates with an angular velocity 'ω' about an axis perpendicular to its plane passing through its centre in a magnetic field of induction 'B' acting perpendicular to the plane of the disc. The induced e.m.f. between the rim and axis of the disc is (magnitude only)

(A) $\frac{B\omega R}{2}$ (B) $\frac{B\omega^2 R^2}{2}$
(C) $\frac{B\omega R^2}{2}$ (D) $\frac{B\omega^2 R}{2}$

49. The relative angular speed of hour hand and second hand of a clock is (in rad/s)

(A) $\frac{421\pi}{11600}$ (B) $\frac{119\pi}{15600}$
(C) $\frac{719\pi}{21600}$ (D) $\frac{311\pi}{578}$

50. A condenser of capacity 'C' is charged to a potential difference of 'V_1'. The plates of the condenser are then connected to an ideal inductor of inductance 'L'. The current through an inductor when the potential difference across the condenser reduces to 'V_2' is

(A) $\frac{C\left(V_1^2 - V_2^2\right)}{L}$ (B) $\frac{C\left(V_1^2 + V_2^2\right)}{L}$
(C) $\left[\frac{C\left(V_1^2 - V_2^2\right)}{L}\right]^{\frac{1}{2}}$ (D) $\left[\frac{C\left(V_1 - V_2\right)}{L}\right]^{\frac{1}{2}}$

1. What is the number of primary carbon atom in the compound ?

(A) 3 (B) 1
(C) Zero (D) 2

2. Which among the following nitrogen bases of polynucleotides is NOT derived from pyrimidine?

(A) Cytosine (B) Uracil
(C) Thymine (D) Guanine

3. Which among the following is not a characteristic of alcohols?

(A) Alcohols are polar molecules due to presence of –OH group.
(B) Lower members of alcohols are insoluble in water as well as in organic solvents.
(C) Boiling point of alcohols increases with increase in their molecular mass.
(D) Methanol is toxic liquid.

4. What is change in internal energy if a system gains xJ of heat and yJ work is done on it?

(A) $x - y$ (B) $-x + y$
(C) $-x - y$ (D) $x + y$

5. Which from following equations is correct for relation between standard cell potential and equilibrium constant?

(A) $E_{cell} = \frac{0.0592}{n} \log_{10} K$

(B) $E_{cell} = \log_{10} K \frac{n}{0.0592}$

(C)(C) $E^{o}_{cell} = \frac{0.0592}{n} \log_{10} K$

(D) $E_{cell} = \log_{10} K \frac{n}{0.0592}$

6. Choose the false statement from following about SN^1 reaction mechanism.

(A) Racemization takes place if reaction is carried out at chiral carbon in optically active substance.
(B) Intermediate formed during the reaction is a carbocation.
(C) Concentration of nucleophile does not affect the rate of reaction.
(D) It is single step mechanism.

7. Which among the following carboxylic acids is found in Lemon?

(A) Acetic acid (B) Citric acid
(C) Formic acid (D) L–Lactic acid

8. If 65 kJ of work is done on the system and it releases 25 kJ of heat. What is change in internal energy of the system?

(A) 90 kJ (B) 16.25 kJ
(C) 2.6 kJ (D) 40 kJ

9. What is the product formed when $CH_3 - CH = CH_2$ is treated with B_2H_6 followed by the action of H_2O_2?

(A) $CH_3CH_2CH_2OH$
(B) $CH_3CH_2CH_3$
(C) CH_3CH_2CHO
(D) $CH_3CH(OH)CH_3$

10. Which among the following species can act as an acid as well as base according to Bronsted-Lowry theory?

(A) HSO_4^- (B) H_3O^+
(C) Cl^- (D) SO_4^{2-}

11. Calculate the number of atoms in 20 gram metal which crystallises to simple cubic structure having unit cell edge length 340 pm. (density of metal = 9.8 g cm^{-3})

(A) 4.95×10^{22}
(B) 5.81×10^{22}
(C) 5.19×10^{22}
(D) 5.42×10^{22}

12. Identify correct pair of properties of $[Co(NH_3)_6]^{3+}$ complex ion.

(A) Low spin, diamagnetic
(B) High spin, diamagnetic
(C) Low spin, paramagnetic
(D) High spin, paramagnetic

13. Identify the correct increasing order of energies of molecular orbitals for F_2 molecule.

(A) $\sigma 1s < \overset{*}{\sigma} 1s < \sigma 2s < \overset{*}{\sigma} 2s$

(B) $\sigma 1s < \sigma 2s < \overset{*}{\sigma} 1s < \overset{*}{\sigma} 2s$

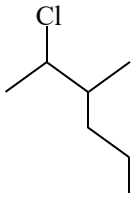
(C) $\sigma 1s < \overset{*}{\sigma} 1s < \overset{*}{\sigma} 2s < \sigma 2s$

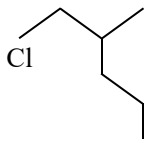
(D)(D) $\overset{*}{\sigma} 1s < \sigma 1s < \overset{*}{\sigma} 2s < \sigma 2s$

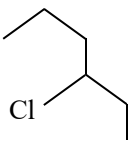
14. Identify the product obtained when sucrose is treated with conc. H_2SO_4.

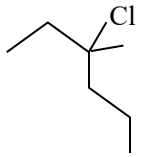
(A) Gluconic acid and fructose
(B) Glucose and fructose
(C) Sugar charcoal and water
(D) Saccharic acid

15. Identify the compound that undergoes SN^1 mechanism most fastly.

(A) 

(B) 

(C) 

(D) 

16. Which among the following statements is against to the principles of green chemistry?
(A) Use of biodegradable polymers help to clean the environment.
(B) Use of renewable resources ensures the sharing of resources by future generation.
(C) Unnecessary derivatization should be minimized.
(D) Protecting and deprotecting functional groups in organic reactions reduces the number of steps.

17. The degree of dissociation of weak acid is 7.2×10^{-4}. What is the value of it's percent dissociation in 0.025 M solution?
(A) 0.80 % (B) 0.062%
(C) 8.2% (D) 0.072%

18. Identify the product Y in the following reaction.

$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3 + 3NaOI \xrightarrow[\Delta]{NaOH, I_2} Y + CH_3 - COONa + 2NaOH$$

(A) CH_4 (B) CH_3I
(C) CHI_3 (D) CH_3OH

19. What is the co-ordination number of hcp crystal lattice?
(A) 8 (B) 12 (C) 6 (D) 4

20. Which is an oxidizing agent in following reaction?

$$Fe_{(s)} + Cu^{2+}_{aq} \longrightarrow Fe^{2+}_{aq} + Cu_{(s)}$$

(A) Fe^{2+}_{aq} (B) $Fe_{(s)}$
(C) Cu^{2+}_{aq} (D) $Cu_{(s)}$

21. What is the relation between molar mass of solute and boiling point elevation of solution?
(A) $M_2 = \frac{1000 \Delta T_b W_2}{K_b W_1}$ (B) $M_2 = \frac{1000 K_b W_2}{\Delta T_b W_1}$
(C) $M_2 = \frac{\Delta T_b W_1}{1000 K_b W_2}$ (D) $M_2 = \frac{1000 K_b W_1}{\Delta T_b W_2}$

22. Under isothermal conditions a gas expands from 0.2 dm^3 to 0.8 dm^3 against a constant pressure of 2 bar at 300 K. Find the work done by the gas. (1 dm^3 bar = 100 J)
(A) 160 J (B) –120 J
(C) –40 J (D) 20 J

23. Calculate final volume of a gas when pressure of 60 mL gas is increased from 1 to 1.5 atm, keeping temperature constant.
(A) 2×10^{-2} dm^3 (B) 3×10^{-2} dm^3
(C) 5×10^{-2} dm^3 (D) 4×10^{-2} dm^3

24. What is the pH of the solution containing 1.342×10^{-3} M H^+ ions? (log 1.342 = 0.1277)
(A) 3.57 (B) 2.38
(C) 2.87 (D) 1.28

25. Identify the product B in the following reaction.
Benzoyl chloride + $H_2O \longrightarrow$ B + HCl
(A) Benzoic acid (B) Benzene
(C) Acetophenone (D) Benzaldehyde

26. Calculate rate constant of a zero order reaction if it is 90% completed in 90 second?
(A) 0.9 mol dm^{-3} s^{-1}
(B) 1.0 mol dm^{-3} s^{-1}
(C) 9.0 mol dm^{-3} s^{-1}
(D) 0.1 mol dm^{-3} s^{-1}

27. How many mole of electrons are required for the reduction of 1 mole of Cr^{3+} to $Cr_{(s)}$?
(A) 1 (B) $\frac{6.022 \times 10^{23}}{3}$
(C) 3 (D) 6

28. Identify anionic complex from following.
(A) Bis (ethylene diamine) dithiocyanato platinum (IV)
(B) Pentaamminecarbonatocobalt (III) chloride
(C) Pentacarbonyliron (0)
(D) Sodiumhexanitrocobaltate (III)

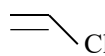
29. Time required for completion of 90% of a first order reaction is 't'. What is the time required for completion of 99.9% of the reaction?
(A) t (B) 2t
(C) 3t (D) $t/2$

30. Which among the following reactions does NOT form alkyl halides?
(A) Alcohol reacts with HCl in presence of anhydrous $ZnCl_2$.
(B) Alcohol reacts with halogen in presence of sunlight.
(C) Alcohol reacts with HI in presence of NaI/H_3PO_4.
(D) Alcohol reacts with HBr in presence of NaBr, H_2SO_4.

31. Which of the following reactions does not match correctly with its name?
(A) $R–CO–NH_2 + Br_2 + \underset{(aq)}{4KOH} \longrightarrow$: Hofmann degradation
(B) $R–NH_2 + 3R–X \longrightarrow$: Hofmann exhaustive alkylation
(C) $R–CO–NH_2 + 4[H] \xrightarrow{LiAlH_4}$: Mendius reduction
(D) $R–CH_2–\overset{+}{N}–(R)_3X^-$ $\xrightarrow[ii)\ \Delta,\ -H_2O]{i)\ moist\ Ag_2O}$: Hofmann elimination

32. Which among the following elements is used in nuclear reactors as moderator?
(A) Ca (B) K (C) Mg (D) Be

33. Which from following is an example of multimolecular colloid?
(A) Cellulose (B) Plastic
(C) S_8 molecule (D) Starch

34. Which from following polymers is obtained using  ?
(A) Buna-S (B) Polyacrylonitrile
(C) PVC (D) Glyptal

35. Calculate the pressure of gas if the solubility of gas in water at 25°C is 6.85×10^{-4} mol dm^{-3}.
(Henry's law constant is 6.85×10^{-4} mol dm^{-3} bar^{-1})
(A) 1 bar (B) 0.5 bar
(C) 1.5 bar (D) 2.0 bar

36. The reagent used in Hofmann elimination reaction is
(A) Moist Ag_2O (B) $LiAlH_4$
(C) Na-Hg/H_2O (D) HNO_2

37. Identify the use of Buna-S from following.
(A) To obtain tyres
(B) To obtain unbreakable dinner ware
(C) To obtain gaskets
(D) To obtain waterpipes

38. What is the molar mass of solute when 2.3 gram non-volatile solute dissolved in 46 gram benzene at 30°C?
(Relative lowering of vapour pressure is 0.06 and molar mass of benzene is 78 gram mol^{-1})
(A) 72 gram mol^{-1} (B) 48 gram mol^{-1}
(C) 65 gram mol^{-1} (D) 80 gram mol^{-1}

39. Identify the correct decreasing order of ease of dehydrohalogenation of alkyl halides.
(A) 2° > 3° > 1° (B) 1° > 3° > 2°
(C) 1° > 2° > 3° (D) 3° > 2° > 1°

40. Which among the following is correct decreasing order of covalent character of ionic bond?
(A) $NaCl > MgCl_2 > AlCl_3$
(B) $AlCl_3 > NaCl > MgCl_2$
(C) $AlCl_3 > MgCl_2 > NaCl$
(D) $MgCl_2 > NaCl > AlCl_3$

41. What is the intermediate product obtained in the preparation of phenol from aniline?
(A) Sodium phenoxide
(B) Benzene diazonium chloride
(C) Anilinium cation
(D) Benzene

42. What is the quantity of sugar charcoal obtained when 34.2 g sugar is charred using required quantity of conc. sulphuric acid under ideal conditions?
(A) 14.4 g (B) 11.0 g
(C) 114 g (D) 10.5 g

43. What is the density of water in kg dm^{-3} if it's density in g cm^{-3} is 0.863?
(A) 7.86 (B) 0.863
(C) 8.63 (D) 4.60

44. Ammonia and oxygen react at high temperature as in reaction,
$4HN_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$
If rate of formation of NO is 3.6×10^{-3} mol L^{-1} sec^{-1}. Calculate the rate of formation of water.
(A) 6.0×10^{-3} mol L^{-1} sec^{-1}
(B) 3.6×10^{-3} mol L^{-1} sec^{-1}(C)
1.8×10^{-3} mol L^{-1} sec^{-1} (D)
5.4×10^{-3} mol L^{-1} sec^{-1}

45. Which from following pair of elements have one electron in 5d-subshell in observed electronic configuration?
(A) Sm (Z=61) and Eu (Z=63)
(B) Gd (Z=64) and Lu (Z=71)
(C) Ce (Z=58) and Nd (Z=60)
(D) Lu (Z=57) and Dy (Z=66)

46. Calculate the wave number of photon emitted during the transition from the orbit n = 2 to n = 1 in hydrogen atom (R_H = 109677 cm^{-1})
(A) 72740 cm^{-1} (B) 83560 cm^{-1}
(C) 82258 cm^{-1} (D) 92820 cm^{-1}

47. Which among the following amino acids is NOT synthesized in our body?
(A) Alanine (B) Valine
(C) Tyrosine (D) Proline

48. Which among the following is an actinoid element?
(A) Pa (B) Lu
(C) Gd (D) Pr

49. Calculate the molar mass of metal having density 22.4g cm^{-3}, crystallizes to form unit cell containing 4 particles. ($a^3 = 5.6 \times 10^{-23}$ cm^3)
(A) 280.2 g mol^{-1} (B) 210.6 g mol^{-1}
(C) 140 g mol^{-1} (D) 188.8 g mol^{-1}

50. What is standard reduction potential of $Cu^{2+}|Cu_{(s)}$ if E° of following cell is 0.46V?
$Cu_{(s)}|\underset{(aq)}{Cu^{2+}} \| \underset{(aq)}{Ag^+}|Ag_{(s)}$ ($E^\circ_{Ag^+/Ag} = 0.80$ V)
(A) 1.56 V (B) 1.44 V
(C) 1.26 V (D) 0.34 V

1. If matrix $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ is such that $AX = I$, where I is 2×2 unit matrix, then $X =$

(A) $\frac{1}{5}\begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$ (B) $\frac{1}{5}\begin{bmatrix} 3 & -2 \\ -4 & 1 \end{bmatrix}$

(C) $\frac{1}{5}\begin{bmatrix} -3 & -2 \\ 4 & 1 \end{bmatrix}$ (D) $\frac{1}{5}\begin{bmatrix} -3 & 2 \\ 4 & 1 \end{bmatrix}$

2. $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} f(x)dx =$

Where $f(x) = \sin|x| + \cos|x|$, $x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

(A) 0 (B) 2

(C) 4 (D) 8

3. The principal solutions of $\tan 3\theta = -1$ are

(A) $\left\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{\pi}{16}, \frac{19\pi}{4}, \frac{23\pi}{4}\right\}$

(B) $\left\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{5\pi}{4}, \frac{19\pi}{12}, \frac{23\pi}{12}\right\}$

(C) $\left\{\frac{\pi}{4}, \frac{\pi}{12}\right\}$

(D) $\left\{\frac{\pi}{4}, \frac{\pi}{12}, \frac{13\pi}{12}, \frac{7\pi}{4}, \frac{19\pi}{4}, \frac{23\pi}{4}\right\}$

4. For three simple statements p, q, and r, $p \rightarrow (q \vee r)$ is logically equivalent to

(A) $(p \vee q) \rightarrow r$

(B) $(p \rightarrow \sim q) \wedge (p \rightarrow r)$

(C) $(p \rightarrow q) \vee (p \rightarrow r)$

(D) $(p \rightarrow q) \wedge (p \rightarrow \sim r)$

5. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}| = |\vec{b}| = \sqrt{2}$ with $\vec{a} \cdot \vec{b} = -1$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{2\pi}{3}$ (B) $\frac{5\pi}{6}$

(C) $\frac{5\pi}{9}$ (D) $\frac{3\pi}{4}$

6. Argument of $\frac{1-i\sqrt{3}}{1+i\sqrt{3}}$ is

(A) 60° (B) 210°

(C) 120° (D) 240°

7. $\int \frac{5\left(x^6+1\right)}{x^2+1} dx =$

(where C is a constant of integration.)

(A) $\frac{5x^7}{7} + 5x + 5\tan^{-1} x + C$

(B) $5\tan^{-1} x + \log(x^2 + 1) + C$

(C) $5(x^2 + 1) + \log(x^2 + 1) + C$

(D) $x^5 - \frac{5x^3}{3} + 5x + C$

8. Let a, b, c be distinct non-negative numbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is

(A) not arithmetic mean of a and b.

(B) the geometric mean of a and b.

(C) the arithmetic mean of a and b.

(D) the harmonic mean of a and b.

9. $\lim\left(\frac{1+\tan x}{1+\sin x}\right)^{\operatorname{cosec} x} =$

(A) 0 (B) e

(C) 1 (D) $\frac{1}{e}$

10. If $y = \sec^{-1}\left(\frac{x+x^{-1}}{x-x^{-1}}\right)$, then $\frac{dy}{dx} =$

(A) $\frac{-2}{1+x^2}$ (B) $\frac{-1}{1+x^2}$

(C) $\frac{2}{1-x^2}$ (D) $\frac{1}{1+x^2}$

11. If the line passing through the points (a, 1, 6) and (3, 4, b) crosses the yz – plane at the point $\left(0, \frac{1}{2}, \frac{-13}{2}\right)$, then

(A) a = 5, b = 1 (B) a = –5, b = 1

(C) a = –5, b = –1 (D) a = 5, b = –1

12. 20 meters of wire is available to fence of a flowerbed in the form of a circular sector. If the flowerbed is to have maximum surface area, then the radius of the circle is

(A) 8 m (B) 5 m

(C) 2 m (D) 4 m

13. Five letters are placed at random in five addressed envelopes. The probability that all the letters are not dispatched in the respective right envelopes is

(A) $\frac{4}{5}$ (B) $\frac{119}{120}$

(C) $\frac{1}{120}$ (D) $\frac{1}{5}$

14. If $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then A =

(A) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

15. The general solution of the differential equation $x^2 + y^2 - 2xy\frac{dy}{dx} = 0$ is

(where C is a constant of integration.)

(A) $2(x^2 - y^2) + x = C$

(B) $x^2 + y^2 = Cy$

(C) $x^2 - y^2 = Cx$

(D) $x^2 + y^2 = Cx$

16. If the lines $2x - 3y = 5$ and $3x - 4y = 7$ are the diameters of a circle of area 154 sq. units, then equation of the circle is

$\left(\text{Taken } \pi = \frac{22}{7}\right)$

(A) $x^2 + y^2 - 2x - 2y - 49 = 0$

(B) $x^2 + y^2 - 2x + 2y - 49 = 0$

(C) $x^2 + y^2 - 2x - 2y - 47 = 0$

(D) $x^2 + y^2 - 2x + 2y - 47 = 0$

17. The joint equation of two lines passing through the origin and perpendicular to the lines given by $2x^2 + 5xy + 3y^2 = 0$ is

(A) $3x^2 - 5xy + 2y^2 = 0$

(B) $3x^2 - 5xy - 2y^2 = 0$

(C) $2x^2 - 5xy + 3y^2 = 0$

(D) $3x^2 + 5xy + 2y^2 = 0$

18. $\int \frac{e^x}{(2+e^x)(e^x+1)} dx =$

(where C is a constant of integration.)

(A) $\log\left(\frac{e^x+2}{e^x+1}\right) + C$

(B) $\log\left(\frac{e^x}{e^x+2}\right) + C$

(C) $\frac{e^x+1}{e^x+2} + C$

(D) $\log\left(\frac{e^x+1}{e^x+2}\right) + C$

19. The function $f(x) = 2x^3 - 9x^2 + 12x + 29$ is monotonically increasing in the interval

(A) $(-\infty,\infty)$ (B) $(-\infty,1) \cup (2,\infty)$

(C) $(-\infty,1)$ (D) $(2,\infty)$

20. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & -3 \\ -1 & 2 & 3 \end{bmatrix}$, then $A_{31} + A_{32} + A_{33} =$

where A_{ij} is cofactor of a_{ij}, where $A = [a_{ij}]_{3\times3}$

(A) 0 (B) 1

(C) 10 (D) 11

21. The objective function of L.L.P. defined over the convex set attains its optimum value at

(A) none of the corner points.

(B) at least two of the corner points.

(C) all the corner points.

(D) at least one of the corner points.

22. A round table conference is to be held amongst 20 countries. If two particular delegates wish to sit together, then such arrangements can be done in_____ways.

(A) 18! (B) $\frac{19!}{2!}$

(C) $2 \times (18)!$ (D) $19! \times 2!$

23. The general solution of differential equation $e^{\frac{1}{7}\left(\frac{dy}{dx}\right)} = 3^x$ is

(where C is a constant of integration.)

(A) $x = (\log 3)y^2 + C$

(B) $y = x^2\log 3 + C$

(C) $y = x\log 3 + C$

(D) $y = 2x\log 3 + C$

24. If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$

(A) $\frac{\log x}{(1+\log x)^2}$ *(B)* $\frac{\log x}{1+\log x}$

(C) $\frac{x\log x}{(1+\log x)^2}$ (D) $\frac{\log x}{x(1+\log x)^2}$

25. The vector projection of $\bar{b}$ on $\bar{a}$, where $\bar{a} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and $\bar{b} = 7\hat{i} - 5\hat{j} - \hat{k}$ is

(A) $\frac{3\left(3\hat{i}+2\hat{j}+5\hat{k}\right)}{\sqrt{38}}$ (B) $\frac{9\hat{i}+6\hat{j}+15\hat{k}}{19}$

(C) $\frac{3\left(3\hat{i}+2\hat{j}+5\hat{k}\right)}{38}$ (D) $\frac{6\left(3\hat{i}+2\hat{j}+5\hat{k}\right)}{\sqrt{38}}$

26. The equation of the line perpendicular to $2x - 3y + 5 = 0$ and making an intercept 3 with positive Y-axis is

(A) $3x + 2y - 6 = 0$

(B) $3x + 2y - 12 = 0$

(C) $3x + 2y - 7 = 0$

(D) $3x + 2y + 6 = 0$

27. If $\int \frac{2e^{x}+3e^{-x}}{3e^{x}+4e^{-x}}dx = Ax + B\log(3e^{2x}+4) + C$, then values of A and B are respectively (where C is a constant of integration.)

(A) $\frac{3}{4}, \frac{1}{24}$ (B) $\frac{4}{3}, -24$

(C) $\frac{1}{4}, \frac{1}{24}$ (D) $\frac{3}{4}, \frac{-1}{24}$

28. If the slope of one of the lines given by $ax^2 + 2hxy + by^2 = 0$ is two times the other, then

(A) $8h^2 = 9ab$ (B) $8h = 9ab$

(C) $8h^2 = 9ab^2$ (D) $8h = 9ab^2$

29. Two numbers are selected at random from the first six positive integers. If X denotes the larger of two numbers, then Var (X) =

(A) $\frac{14}{3}$ (B) $\frac{14}{9}$

(C) $\frac{\cdot}{3}$ (D) $\frac{\cdot}{3}$

30. The ratio in which the plane $\vec{r}\cdot\left(\hat{i}-2\hat{j}+3\hat{k}\right) = 17$ divides the line joining the points $-2\hat{i}+4\hat{j}+7\hat{k}$ and $3\hat{i}-5\hat{j}+8\hat{k}$ is

(A) 5 : 3 (B) 4 : 5

(C) 3 : 10 (D) 10 : 3

31. If surrounding air is kept at 20 °C and body cools from 80 °C to 70 °C in 5 minutes, then the temperature of the body after 15 minutes will be

(A) 54.7 °C (B) 51.7 °C

(C) 52.7 °C (D) 50.7 °C

32. A random variable X has the following probability distribution

X	0	1	2	3	4	5	6
P (X)	k	3k	5k	7k	9k	11k	13k

then P ($X \geq 2$) =

(A) $\frac{1}{49}$ (B) $\frac{45}{49}$

(C) $\frac{40}{49}$ (D) $\frac{15}{49}$

33. Give that $f(x) = \frac{1-\cos 4x}{x^2}$ if $x < 0$

$= a$ if $x = 0$

$= \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}$ if $x > 0$,

is continuous at $x = 0$, then a =

(A) 16 (B) 2

(C) 4 (D) 8

34. The area of the region bounded by the y-axis, $y = \cos x$, $y = \sin x$, when $0 \leq x \leq \frac{\pi}{4}$, is

(A) $\sqrt{2}$ sq. units

(B) $2\left(\sqrt{2}-1\right)$ sq. units

(C) $\left(\sqrt{2}-1\right)$ sq. units

(D) $\left(\sqrt{2}+1\right)$ sq. units

35. Given three vectors $\bar{a}$, $\bar{b}$, $\bar{c}$, two of which are collinear. If $\bar{a}+\bar{b}$ is collinear with $\bar{c}$ and $\bar{b}+\bar{c}$ is collinear with $\bar{a}$ and $|\bar{a}| = |\bar{b}| = |\bar{c}| = \sqrt{2}$, then $\bar{a}\cdot\bar{b}+\bar{b}\cdot\bar{c}+\bar{c}\cdot\bar{a} =$

(A) –3 (B) 5

(C) 3 (D) –1

36. In a triangle ABC, with usual notations $\angle A = 60°$, then $\left(1+\frac{a}{c}+\frac{b}{c}\right)\left(1+\frac{c}{b}-\frac{a}{b}\right) =$

(A) 3 (B) $\frac{1}{2}$

(C) $\frac{3}{2}$ (D) 1

37. If $y = 4x - 5$ is tangent to the curve $y^2 = px^3 + q$ at (2, 3), then

(A) p = –2, q = 7 (B) p = 2, q = –7

(C) p = 2, q = 7 (D) p = –2, q = –7

38. Which of the following statement pattern is a contradiction?

(A) $S_4 \equiv (\sim p \wedge q) \vee (\sim q)$

(B) $S_2 \equiv (p \rightarrow q) \vee (p \wedge \sim q)$

(C) $S_1 \equiv (\sim p \vee \sim q) \vee (p \vee \sim q)$

(D) $S_3 \equiv (\sim p \wedge q) \wedge (\sim q)$

39. Let $\cos(\alpha+\beta) = \frac{4}{5}$ and $\sin(\alpha-\beta) = \frac{5}{13}$, where $0 \leq \alpha, \beta \leq \frac{\pi}{4}$, then $\tan 2\alpha =$

(A) $\frac{20}{7}$ (B) $\frac{56}{33}$

(C) $\frac{19}{12}$ (D) $\frac{25}{16}$

40. If the position vectors of the points A and B are $3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-2\hat{j}-4\hat{k}$ respectively, then the equation of the plane through B and perpendicular to AB is

(A) $2x + 3y + 6z + 28 = 0$

(B) $2x + 3y + 6z - 11 = 0$

(C) $2x - 3y - 6z - 32 = 0$

(D) $2x + 3y + 6z + 9 = 0$

41. The particular solution of the differential equation $\frac{dy}{dx} - e^x = ye^x$, when $x = 0$ and $y = 1$ is

(A) $\log\left|\frac{y-1}{\sqrt{2}}\right| = e^x - 1$

(B) $\log(y-1) = e^x - 1$

(C) $\log 2(y-1) = e^x - 1$

(D) $\log\left|\frac{y+1}{\sqrt{2}}\right| = e^x - 1$

42. If the standard deviation of first n natural numbers is 2, then the value of n is

(A) 6 (B) 7

(C) 5 (D) 4

43. If $\bar{a}, \bar{b}, \bar{c}$ are position vectors of points A, B, C respectively, with $2\bar{a} + 3\bar{b} - 5\bar{c} = \bar{0}$, then the ratio in which point C divides segment AB is

(A) 3:2 externally (B) 2:3 externally

(C) 3:2 internally (D) 2:3 internally

44. The second derivative of $a\sin^3 t$ w.r.t. $a\cos^3 t$ at $t = \pi/4$ is

(A) $\frac{-4\sqrt{2}}{3a}$ (B) $\frac{4\sqrt{2}}{3a}$

(C) $\frac{4\sqrt{3}}{3a}$ (D) $\frac{12}{a}$

45. $\int_2^3 \frac{\log x}{x} dx =$

(A) $\frac{1}{2}\log 6 \log 3$ (B) $\log 6 \log \frac{3}{2}$

(C) $\frac{1}{2}\log 6 \log \frac{3}{2}$ (D) $2\log 6 \log \frac{3}{2}$

46. With reference to the principal values, if $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then $x^{100} + y^{100} + z^{100} =$

(A) 1 (B) 2 (C) 3 (D) 6

47. For the differential equation $\left[1 - \left(\frac{dy}{dx}\right)^2\right]^{\frac{5}{2}} = 8\frac{d^2y}{dx^2}$ has the order and degree_____respectively.

(A) 2 and 6 (B) 2 and 3

(C) 2 and 2 (D) 2 and 1

48. The angle between two lines $\frac{x+1}{} = \frac{y+3}{} = \frac{z-4}{}$ and $\frac{x-4}{1} = \frac{y+4}{2} = \frac{z+1}{2}$ is

(A) $\cos^{-1}\left|\frac{4}{9}\right|$ (B)

(C) $\cos^{-1}\left|\frac{2}{9}\right|$ (D)

49. If $f(x) = \frac{a^x - a^{-x}}{a^x + a^{-x}}$, where a, x satisfy the necessary conditions, then $f^{-1}(x) =$

(A) $\frac{1}{2}\log_a\left(\frac{x}{1-x}\right)$ (B) $\frac{1}{2}\log_a\left(\frac{1+x}{x}\right)$

(C) $\frac{1}{2}\log_a\left(\frac{1+x}{1-x}\right)$ (D) $\frac{1}{2}\log_a\left(\frac{2+x}{2-x}\right)$

50. For a Binomial distribution, n = 6, if $9P(X = 4) = P(X = 2)$, then q =

(A) $\frac{2}{5}$ (B) $\frac{3}{4}$

(C) $\frac{1}{4}$ (D) $\frac{1}{2}$

2 2

$\cos^{-1}\left(\frac{1}{\quad}\right)$ $\left|\frac{}{9}\right|$

$\cos^{-1}\left(\frac{5}{\quad}\right)$ $\left|\frac{}{9}\right|$