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COMMON ENTRANCE TEST - 2012

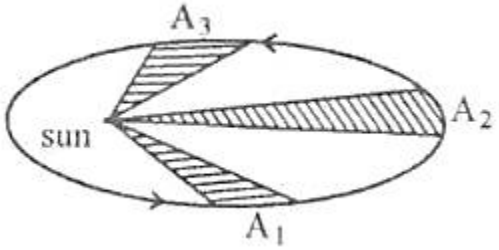
PHYSICS

1. The dimensional formula of physical quantity is $M^aL^bT^c$. Then that physical quantity is
   (1) surface tension if a = 1, b = 1, c = -2
   (2) force if a = 1, b = 1, c = 2
   (3) angular frequency if a = 0, b = 0, c = -1
   (4) spring constant if a = 1, b = - 1, c = - 2

2. A person throws balls into air vertically upward in regular intervals of time of one second. The next ball is thrown when the velocity of the ball thrown earlier becomes zero. The height to which the balls rise is……..
   (Assume, g = 10 ms^{-2})
   (1) 5 m
   (2) 10 m
   (3) 7.5 m
   (4) 20 m

3. The circular motion of a particle with constant speed is
   (1) periodic but not SHM
   (2) SHM but not periodic
   (3) Periodic and also SHM
   (4) neither periodic nor SHM

4. A planet moving around sun sweeps area A_1 in 2 days, A_2 in 3 days and A_3 in 6 days. Then the relation between A_1, A_2 and A_3 is



   (1) $3A_1 = 2A_2 = A_3$
   (2) $2A_1 = 3A_2 = 6A_3$
   (3) $3A_1 = 2A_2 = 6A_3$
   (4) $6A_1 = 3A_2 = 2A_3$

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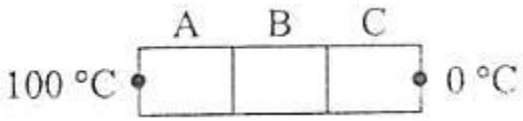
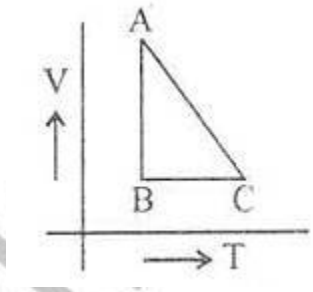
5. A, B and C are the three identical conductors but made from different materials. They are kept in contact as shown.



Their thermal conductivities are K, 2K and K/2. The free end of A is at 100°C and the free end of C is at 0°C. During steady state, the temperature of the junction of A and B is nearly …..°C.

(1) 71
(2) 29
(3) 63
(4) 37

6. One mole of an ideal gas is taken from A to B, from B to C and then back to A. The variation of its volume with temperature for that change is as shown. Its pressure at A is P_0, volume is V_0. Then, the internal energy



(1) at A is more than at B
(2) at C is less than at B
(3) at B is more than at A
(4) at A and B are equal

7. Which of the following is incorrect?

(1) If the wave is longitudinal, it must be a mechanical wave.
(2) If the wave is mechanical, it may Or may not be a transverse wave.
(3) Mechanical waves cannot propagate in vacuum.
(4) 'Diffraction' helps us to distinguish between sound wave and light wave.

8. Intensity level of sound whose intensity is 10^{-8} wm^{-2} is ……..dB

(1) 8
(2) 4
(3) 40
(4) 80

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9. A point source of light is kept below the surface of water ($n_w = 4/3$) at a depth of √7 m. The radius of the circular bright patch of light noticed on the surface of water is ….. m.
   (1) $\frac{3}{\sqrt{7}}$
   (2) 3
   (3) $\frac{\sqrt{7}}{3}$
   (4) $\sqrt{7}$

10. A monochromatic beam of light is travelling from medium A of refractive index n_1 to a medium B of refractive index n_2. In the medium A, there are x number of waves in certain distance. In the medium B, there are y number of waves in the same distance. Then, refractive index of medium A with respect to medium B is….
   (1) y/x
   (2) $\sqrt{\frac{x}{y}}$
   (3) $\frac{x}{y-x}$
   (4) x/y

11. In Young's double slit experiment, fringes of width ß are produced on a screen kept at a distance of 1 m from the slit. When the screen is moved away by 5×10^{-2} m, fringe width changes by 3×10^{-5} m. The separation between the slits is 1×10^{-3} m. The wavelength of the light used is ……nm.
   (1) 500
   (2) 600
   (3) 700
   (4) 400

12. For sustained interference fringes in double slit experiment, essential condition/s is/are
   (a) sources must be coherent
   (b) the intensities of the two sources must be equal
   Here, the correct option/s is/are
   (1) both (a) (b)
   (2) only (a)
   (3) only (b)
   (4) neither (a) nor (b)

13. In single slit experiment, the width of the slit is reduced. Then, the linear width of the principal maxima…….
   (1) increases but becomes less bright
   (2) decreases but becomes more bright
   (3) increases but becomes more bright
   (4) decreases but becomes less bright

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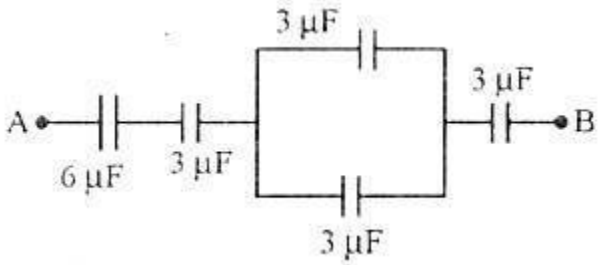
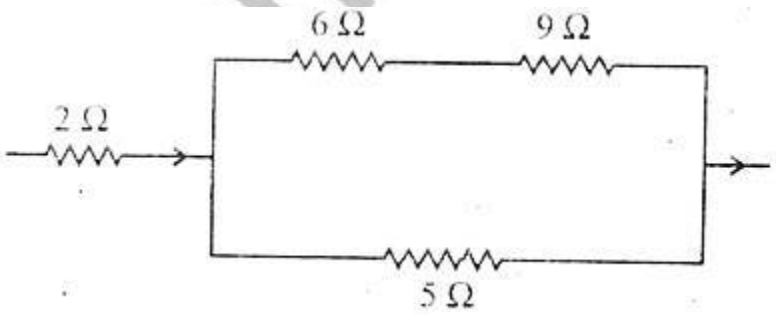
14. In the uniform electric field of $E = 1 \times 10^4\ NC^{-1}$, an electron is accelerated from rest. The velocity of the electron when it has travelled a distance of 2×10^{-2} m is nearly .....ms^{-1} (e/m of electron $\simeq 1.8 \times 10^{11}\ C\ kg^{-1}$)
    (1) 1.6×10^6
    (2) 0.85×10^6
    (3) 0.425×10^6
    (4) 8.5×10^6

15. In this diagram, the P.D. between A and B is 60 V, The P.D. across 6μF capacitor is V



    (1) 10
    (2) 5
    (3) 20
    (4) 4

16. In this circuit, when certain current flows, the heat produced in 5 Ω is 4.05 J in a time t. The heat produced in 2 Ω coil in the same time interval is



    (1) 5.76
    (2) 1.44
    (3) 2.88
    (4) 2.02

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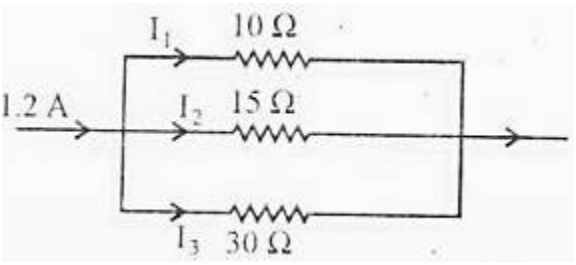
17. In this circuit, the value of I_2 is



(1) 0.2 A
(2) 0.3 A
(3) 0.4 A
(4) 0.6 A

18. A straight current carrying conductor is kept along the axis of circular loop carrying current. The force exerted by the straight conductor on the loop is _____
(1) perpendicular to the plane of the loop
(2) in the plane of the loop, away from the center
(3) in the plane of the loop, towards the center
(4) zero

19. A resistor of 500 Ω, an inductance of 0.5 H are in series with an a.c. which is given by V = 100√2 sin (1000 t). The power factor of the combination is
(1) $\frac{1}{\sqrt{2}}$
(2) $\frac{1}{\sqrt{3}}$
(3) 0.5
(4) 0.6

20. Pick out the WRONG statement.
(1) The gain in the K.E. of the electron moving at right angles to the magnetic field is zero.
(2) When an electron is shot at right angles to the electric field, it traces a parabolic path.
(3) An electron moving in the direction of the electric field gains K.E.
(4) An electron at rest experiences no force in the magnetic field.

21. A proton and an alpha particle are accelerated under the same potential difference. The ratio of de-Broglie wavelengths of the proton and the alpha particle is
(1) $\sqrt{8}$
(2) $\frac{1}{\sqrt{8}}$
(3) 1
(4) 2

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22. Spectrum of sunlight is an example for
    (1) Band emission spectrum
    (2) Line absorption spectrum
    (3) Continuous emission spectrum
    (4) Continuous absorption spectrum

23. In hydrogen atom, electron excites from ground state to higher energy state and its orbital velocity is reduced to 1/3rd of its initial value. The radius of the orbit in the ground state is R. The radius of the orbit in that higher energy state is……..
    (1) 2 R
    (2) 3 R
    (3) 27 R
    (4) 9 R

24. Decay constants of two radio-active samples A and B are 15x and 3x respectively. They have equal number of initial nuclei. The ratio of the number of nuclei left in A and B after a time 1/6x is
    (1) e
    (2) e^2
    (3) e^{-1}
    (4) e^{-2}

25. Mass numbers of the elements A, B, C and D are 30, 60, 90 and 120 respectively. The specific binding energy of them 5 MeV, 8.5 MeV, 8 MeV and 7 MeV respectively. Then, in which of the following reaction/s energy is released?
    (a) D → 2B
    (b) C →B + A
    (c) B → 2A
    (1) only in (a)
    (2) in (b), (c)
    (3) in (a), (c)
    (4) in (a), (b) and (c)

26. Copper and Germanium are cooled from room temperature to 100 K. Then the resistance of
    (1) Germanium decreases, Copper increases
    (2) Germanium decreases, Copper decreases
    (3) Germanium increases, Copper decreases
    (4) Germanium increases, Copper increases

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27. The most stable particle in the Baryon group is
    (1) neuton
    (2) proton
    (3) lamda particle
    (4) sigma particle

28. Frequencies of light incident on a system of scattering particles are in the ratio of 1: 2. Then, the intensity of scattered light in a particular direction is……
    (1) 1 : 4
    (2) 1 : 2
    (3) 1 : 8
    (4) 1 : 16

29. The ratio of the magnetic dipole moment to the angular momentum of the electron in the 1^{st} orbit of hydrogen atom is
    (1) e/2m
    (2) e/m
    (3) 2m/e
    (4) m/e

30. Milk is an example for
    (1) inelastic gel
    (2) foam
    (3) elastic gel
    (4) emulsion

31. A body of mass 'm' is travelling with a velocity 'u'. When a constant retarding force 'F' is applied, it comes to rest after travelling a distance 's_1'. If the initial velocity is '2u', with the same force 'F', the distance travelled before it comes to rest is 'S_2'. Then
    (1) $s_2 = 2s_1$
    (2) $s_2 = s_1/2$
    (3) $s_2 = s_1$
    (4) $s_2 = 4s_1$

32. A block kept on a rough surface starts sliding when the inclination of the surface is 'θ' with respect to the horizontal. The coefficient of static friction between the block and the surface is
    (1) sin θ
    (2) tan θ
    (3) cos θ
    (4) sec θ

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33. Two bodies of masses m_1 and m_2 are acted upon by a constant force F for a time t. They start from rest and acquire kinetic energies E_1 and E_2 respectively. Then E_1/E_2 is
    (1) $\frac{m_1}{m_2}$
    (2) $\frac{m_2}{m_1}$
    (3) 1
    (4) $\frac{\sqrt{m_1 m_2}}{m_1+m_2}$

34. The X and Y components of a force F acting at 30° to x-axis are respectively
    (1) $\frac{F}{\sqrt{2}}, F$
    (2) $\frac{F}{2}, \frac{\sqrt{3}}{2}F$
    (3) $\frac{\sqrt{3}}{2}F, \frac{1}{2}F$
    (4) $F, \frac{F}{\sqrt{2}}$

35. Spheres of iron and lead having same mass are completely immersed in water. Density of lead is more than that of iron. Apparent loss of weight is W_1 for iron sphere and W_2 for lead sphere. Then $\frac{W_1}{W_2}$ is
    (1) = 1
    (2) between 0 and 1
    (3) = 0
    (4) > 1

36. A hot body is allowed to cool. The surrounding temperature is constant at 30°C. The body takes time t_1 to cool from 90° C to 89°C and time t_2 to cool from 60°C to 59.5°C. Then,
    (1) $t_2 = 2t_1$
    (2) $t_2 = t_1/2$
    (3) $t_2 = 4t_1$
    (4) $t_2 = t_1$

37. A particle executes SHM with amplitude 0.2 m and time period 24 s. The time required for it to move from the mean position to a point 0.1 m from the mean position is
    (1) 2 s
    (2) 3 s
    (3) 8 s
    (4) 12 s

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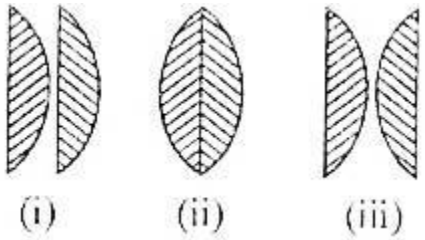
38. White light is incident normally on a glass slab. Inside the glass slab,
    (1) red light travels faster than other colours
    (2) violet light travels faster than other colours
    (3) yellow light travels faster than other colours
    (4) all colours travel with the same speed

39. Two thin plano-convex lenses each of focal length f are placed as shown in the figure. The ratio of their effective focal lengths in the three cases is



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

40. If the two slits in Young's double slit experiment are of unequal width, then
    (1) the bright fringes will have unequal spacing.
    (2) the bright fringes will have unequal brightness.
    (3) the fringes do not appear.
    (4) The dark fringes are not perfectly dark.

41. The phenomenon of polarization shows that light has _____ nature.
    (1) particle
    (2) transverse
    (3) longitudinal
    (4) dual

42. Acceleration of a charged particle of charge 'q' and mass 'm' moving in a uniform electric field of strength 'E' is
    (1) $\frac{qE}{m}$
    (2) $\frac{m}{qE}$
    (3) mqE
    (4) $\frac{q}{mE}$

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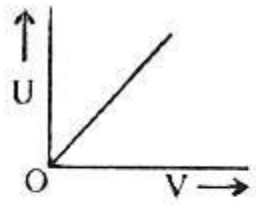
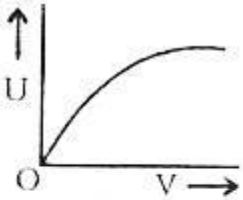
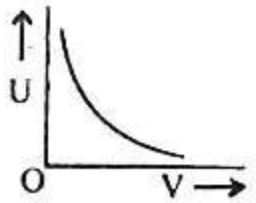
43. Two fixed charges A and B of 5μC each are separated by a distance of 6 m. C is the mid point of the line joining A and B. A charge 'Q' of – 5 μ C is shot perpendicular to the line joining A and B through C with a kinetic energy of 0.06 J. The charge 'Q' comes to rest at a point D. The distance CD is
    (1) 3 m
    (2) √3 m
    (3) 3√3 m
    (4) 4 m

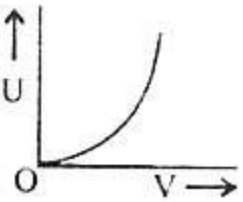
44. A capacitor of capacitance 10μF is charged to 10 V. The energy stored in it is
    (1) 100 μ J
    (2) 500 μ J
    (3) 1000 μ J
    (4) 1 μ J

45. Which of the following graphs correctly represents the variation of heat energy (U) produced in a metallic conductor in a given time as a function of potential difference (V) across the conductor?

(1) 

(2) 

(3) 

(4) 

46. A current of 2A is passing through a metal wire of cross sectional area $2 \times 10^{-6} m^2$. If the number density of free electrons in the wire is $5 \times 10^{26}\ m^{-3}$, the drift speed of electrons is (given $e = 1.6 \times 10^{-19}$ C)
    (1) $\frac{1}{16}\ ms^{-1}$
    (2) $\frac{1}{40}\ ms^{-1}$
    (3) $\frac{1}{80}\ ms^{-1}$
    (4) $\frac{1}{32}\ ms^{-1}$

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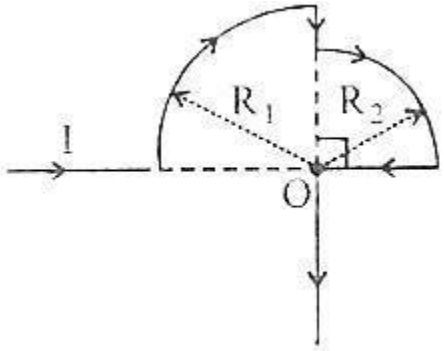
47. Magnetic field at a distance r from an infinitely long straight conductor carrying a steady current varies as
    (1) $\frac{1}{r^2}$
    (2) $\frac{1}{r}$
    (3) $\frac{1}{r^3}$
    (4) $\frac{1}{\sqrt{r}}$

48. In the loop shown, the magnetic induction at the point 'O' is



    (1) $\frac{\mu_0 I}{8}\left(\frac{R_1 - R_2}{R_1 R_2}\right)$
    (2) $\frac{\mu_0 I}{8}\left(\frac{R_1 + R_2}{R_1 R_2}\right)$
    (3) $\frac{\mu_0 I}{8}\left(\frac{R_1 R_2}{R_1 + R_2}\right)$
    (4) Zero

49. An α-particle and a proton moving with the same kinetic energy enter a region of uniform magnetic field at right angle to the field. The ratio of the radii of the paths of α-particle to that of the proton is
    (1) 1 : 1
    (2) 1 : 2
    (3) 1 : 4
    (4) 1 : 8

50. Direction of current induced in a wire moving in a magnetic field is found using
    (1) Fleming's left hand rule
    (2) Fleming's right hand rule
    (3) Ampere's rule
    (4) Right hand clasp rule

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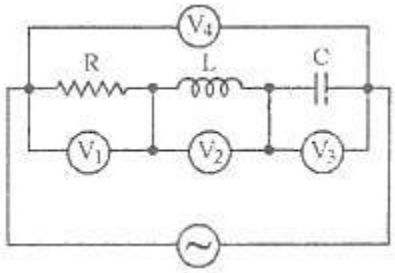
51. An ideal resistance R, ideal inductance L, ideal capacitance C and AC volt meters V_1, V_2, V_3 and V_4 are connected to an AC source as shown. At resonance,



(1) reading in V_3 = reading in V_1
(2) reading in V_1 = reading in V_2
(3) reading in V_2 = reading in V_4
(4) reading in V_2 = reading in V_3

52. X-rays, gamma rays and microwaves travelling in vacuum have
(1) same wavelength but different velocities
(2) same frequency but different velocities
(3) same velocity but different wavelengths
(4) same velocity and same frequency

53. If n is the orbit number of the electron in a hydrogen atom, the correct statement among the following is
(1) electron energy increases as n increases
(2) hydrogen emits infrared rays for the electron transition from n = ∞ to n = 1.
(3) electron energy is zero for n = 1
(4) electron energy varies as n^2.

54. In a Ruby laser, the colour of laser light is due to _____ atom.
(1) Oxygen
(2) Aluminium
(3) Xenon
(4) Chromium

55. The radius of $_{29}Cu^{64}$ nucleus in Fermi is (given $R_0 = 1.2 \times 10^{-15}$ m)
(1) 4.8
(2) 1.2
(3) 7.7
(4) 9.6

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56. In a radioactive decay, an element ${}_zX^A$ emits four α-particles, three ß-particles and eight gamma photons. The atomic number and mass number of the resulting final nucleus are
    (1) Z – 11, A – 16
    (2) Z – 5, A – 13
    (3) Z – 5, A – 16
    (4) Z – 8, A – 13

57. For a transistor, ß = 100. The value of α is
    (1) 1.01
    (2) 0.99
    (3) 100
    (4) 0.01

58. The following truth table with A and B as inputs is for _____ gate.

A	B	Output
1	0	1
1	1	0
0	1	1
0	0	0

    (1) AND
    (2) OR
    (3) XOR
    (4) NOR

59. 'n' photons of wavelength 'λ' are absorbed by a black body of mass 'm'. The momentum gained by the body is
    (1) $\frac{h}{m\lambda}$
    (2) $\frac{mnh}{\lambda}$
    (3) $\frac{nh}{m\lambda}$
    (4) $\frac{nh}{\lambda}$

60. A radioactive nucleus has specific binding energy 'E_1'. It emits an α-particle. The resulting nucleus has specific energy 'E_2'. Then
    (1) $E_2 = E_1$
    (2) $E_2 < E_1$
    (3) $E_2 > E_1$
    (4) $E_2 = 0$

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CHEMISTRY

1. The mass of a non-volatile solute of molar mass 40 g mol^{-1} that should be dissolved in 114 g of octane to lower its vapour pressure by 20% is
   (1) 10 g
   (2) 11.1 g
   (3) 9.8 g
   (4) 12.8 g

2. During the adsorption of a gas on the surface of a solid, which of the following is TRUE?
   (1) $\Delta G < O, \Delta H > O, \Delta S < O$
   (2) $\Delta G > O, \Delta H < O, \Delta S < O$
   (3) $\Delta G < O, \Delta H < O, \Delta S < O$
   (4) $\Delta G < O, \Delta H < O, \Delta S > O$

3. The approximate time duration in hours to electroplate 30g of calcium from molten calcium chloride using a current of 5 amp is
   [At. Mass of Ca = 40]
   (1) 8
   (2) 80
   (3) 10
   (4) 16

4. The pH of the solution obtained by mixing 100 ml of a solution of pH = 3 with 400 ml of a solution of pH = 4 is
   (1) 3 – log 2.8
   (2) 7 – log 2.8
   (3) 4 – log 2.8
   (4) 5 – log 2.8

5. The equilibrium constant of the reaction:
   $A_{(s)} + 2B^{+}_{(aq)} \rightleftharpoons A^{2+}_{(aq)} + 2B_{(s)}; E^{\circ}_{cell} = 0.0295\ V$ is
   $\left[\frac{2.303\ RT}{F} = 0.059\right]$
   (1) 10
   (2) 2×10^2
   (3) 3×10^2
   (4) 2×10^5

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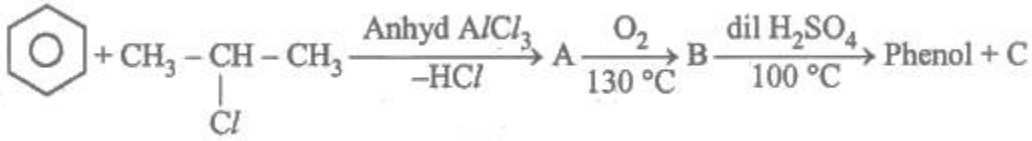
6. An oxygen containing organic compound was found to contain 52% carbon and 13% of hydrogen. Its vapour density is 23. The compound reacts with sodium metal to liberate hydrogen. A functional isomer of this compound is
   (1) Ethanol
   (2) Ethanal
   (3) Methoxy Methane
   (4) Methoxy Ethane

7. Which one of the following is NOT true regarding electromeric effect?
   (1) It results in the appearance of partial charges on the carbon atoms.
   (2) It is a temporary effect.
   (3) It operates on multiple bonds.
   (4) It requires an attacking reagent.

8. Which one of the following is NOT formed when a mixture of methyl bromide and bromobenzene is heated with sodium metal in the presence of dry Ether?
   (1) Ethane
   (2) Diphenyl
   (3) Propane
   (4) Toluene

9. Power alcohol is a mixture of
   (1) 80% Petrol + 20% Benzene + Small quantity of Ethanol
   (2) 80% Petrol + 20% Ethanol + Small quantity of Benzene
   (3) 80% Ethanol + 20% Benzene + Small quantity of Petrol
   (4) 50% Petrol + 50% Ethanol + Small quantity of Benzene

10. Identify 'C' in the following:



   (1) Water
   (2) Ethanol
   (3) Propanone
   (4) Cumene hydroperoxide

11. 20 ml of methane is completely burnt using 50 ml of oxygen. The volume of the gas left after cooling to room temperature is
   (1) 80 ml
   (2) 40 ml
   (3) 60 ml

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(4) 30 ml

12. 100 ml of 0.1 M acetic acid is completely neutralized using a standard solution of NaOH. The volume of Ethane obtained at STP after the complete electrolysis of the resulting solution is
    (1) 112 ml
    (2) 56 ml
    (3) 224 ml
    (4) 560 ml

13. Saccharin, an artificial sweetner, is manufactured from
    (1) Cellulose
    (2) Toluene
    (3) Cyclohexane
    (4) Starch

14. Which of the following is NOT TRUE for S_N^1 reaction?
    (1) Favoured by polar solvents.
    (2) 3°- alkyl halides generally react through S_N^1 reaction.
    (3) The rate of the reaction does not depend upon the molar concentration of the mucleohile.
    (4) 1° - alkyl halides generally react through S_N^1 reaction.

15. Oil of winter green is
    (1) an ester
    (2) a carboxylic acid
    (3) an alcohol
    (4) a ketone

16. An organic compound 'A' burns with a sooty flame. It is negative towards Tollen's reagent test and positive for Borsche's reagent test. The compound 'A' is
    (1) Benzaldehyde
    (2) Acetophenone
    (3) Acetone
    (4) Salicylic acid

17. For a reaction: A + B → Products, the rate of the reaction at various concentrations are given below:

Expt No	[A]	[B]	Rate (mol dm^{-3} s^{-1})
1	0.2	0.2	2
2	0.2	0.4	4
3	0.6	0.4	36

The rate law for the above reaction is

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(1) $r = K[A]^2[B]$
(2) $r = K[A][B]$
(3) $r = K[A]^3[B]$
(4) $r = K[A]^2[B]^2$

18. Which one of the following has NO unpaired electrons?
(1) O_2
(2) O^-_2
(3) O^+_2
(4) $O^-_2{}^-$

19. The atomic number of cobalt is 27. The EAN of cabalt in $Na_3[Co(NO_2)_4Cl_2]$ is
(1) 35
(2) 24
(3) 36
(4) 34

20. The "spin only" magnetic moment of Ni^{2+} in aqueous solution would be
[At No. of Ni = 28]
(1) $\sqrt{6}$ BM
(2) $\sqrt{15}$ BM
(3) $\sqrt{2}$ BM
(4) $\sqrt{8}$ BM

21. Impossible orbital among the following is
(1) 2s
(2) 3f
(3) 2p
(4) 4d

22. The total number of electrons in 18 ml of water (density = 1 g mol^{-1}) is
(1) 6.02×10^{23}
(2) 6.02×10^{25}
(3) 6.02×10^{24}
(4) $6.02 \times 18 \times 10^{23}$

23. The number of moles of hydrogen that can be added to 1 mole of an oil is the highest in
(1) Linseed oil
(2) Groundnut oil
(3) Sunflower seed oil
(4) Mustard oil

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24. The reaction between sodium and water can be made less vigorous by
    (1) lowering the temperature
    (2) adding a little alcohol
    (3) amalgamating sodium
    (4) adding a little acetic acid

25. All colloidal dispersions have
    (1) very high osmotic pressure
    (2) low osmotic pressure
    (3) no osmotic pressure
    (4) high osmotic pressure

26. Silver iodide is used for producing artificial rain because AgI
    (1) is easy to spray at high altitude
    (2) is easy to synthesize
    (3) has crystal structure similar to ice
    (4) is insoluble in water

27. The equilibrium constant of a reaction is 0.008 at 298 K. The standard free energy change of the reaction at the same temperature is
    (1) + 11.96 kJ
    (2) – 11.96 kJ
    (3) – 5.43 KJ
    (4) – 8.46 kJ

28. The function of potassium ethyl xanthate in froth floatation process is to make the ore
    (1) attracted toward water
    (2) water repellant
    (3) lighter
    (4) heavier

29. The correct order of electro negativities of N, O, F & P is
    (1) F > N > P > O
    (2) F > O > P > N
    (3) F > O > N > P
    (4) N > O > F > P

30. The s-block element used as a catalyst in the manufacture of Buna-S rubber is
    (1) Mg
    (2) Ca
    (3) Ba
    (4) Na

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31. Which of the following is NOT a characteristic of a covalent compound?
    (1) Low melting point
    (2) No definite geometry
    (3) Insoluble in polar solvent
    (4) Small difference in electronegativity between the combining atoms.

32. The volume of 0.1 M oxalic acid that can be completely oxidize by 20 ml of 0.025 M $KMnO_4$ solution is
    (1) 125 ml
    (2) 25 ml
    (3) 12.5 ml
    (4) 37.5 ml

33. A ligand is
    (1) Lewis acid
    (2) Bronsted acid
    (3) eiher a Lewis acid or a Lewis base
    (4) Lewis base

34. The vapour pressure of two liquids A and B in their pure states are in the ratio of 1 : 2. A binary solution of A and B contains A and B in the mole proportion of 1 : 2. The mole fraction of A in the vapour phase of the solution will be
    (1) 0.33
    (2) 0.2
    (3) 0.25
    (4) 0.52

35. Which of the following statements is TRUE?
    (1) The total entropy of the universe remains constant.
    (2) The total entropy of the universe is continuously decreasing.
    (3) The total energy of the universe is continuously decreasing.
    (4) The total energy of the universe remains constant.

36. 5 ml of 0.4 N NaOH is mixed with 20 ml of 0.1 N HCl. The pH of the resulting solution will be
    (1) 6
    (2) 7
    (3) 8
    (4) 5

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37. On adding which of the following, the pH of 20 ml of 0.1 N HCl will not alter?
    (1) 1 ml of 1 N HCl
    (2) 20 ml of distilled water
    (3) 1 ml of 0.1 N NaOH
    (4) 500 ml of HCl of pH = 1

38. Which one of the following has a potential more than zero?
    (1) $\mathrm{Pt}, \frac{1}{2}\ \mathrm{H_2}\ (1\ \mathrm{atm})\ |\ \mathrm{HCl}\ (1\ \mathrm{M})$
    (2) $\mathrm{Pt}, \frac{1}{2}\ \mathrm{H_2}\ (1\ \mathrm{atm})\ |\ \mathrm{HCl}\ (2\ \mathrm{M})$
    (3) $\mathrm{Pt}, \frac{1}{2}\ \mathrm{H_2}\ (1\ \mathrm{atm})\ |\ \mathrm{HCl}\ (0.1\ \mathrm{M})$
    (4) $\mathrm{Pt}, \frac{1}{2}\ \mathrm{H_2}\ (1\ \mathrm{atm})\ |\ \mathrm{HCl}\ (0.5\ \mathrm{M})$

39. HCHO was treated with a reagent X. The product formed upon hydrolysis in the presence of an acid gave C_2H_5OH. The reagent X is
    (1) aqueous KOH
    (2) alcoholic KOH
    (3) alcoholic KCN
    (4) CH_3 Mgl

40. Benzylamine is a stronger base than aniline because
    (1) The lone pair of electrons on the nitrogen atom in benzylamine is delocalized.
    (2) The lone pair of electrons on the nitrogen atom in aniline is delocalized.
    (3) The lone pair of electrons on the nitrogen atom in aniline is not involved in resonance.
    (4) Benzylamine has a higher molecular mass than aniline.

41. The relative acidic strength of benzoic acid, o-toluic acid and p-toluic acid is of the decreasing order:
    (1) p-toluic acid > o-toluci acid > benzoic acid
    (2) o-toluic acid > p-toluci acid > benzoic acid
    (3) p-toluic acid > benzoic acid > o-toluic acid
    (4) o-toluic acid > benzoic acid > p-toluic acid

42. The C-H bond and C-C bond in ethane are formed by which of the following types of overlap?
    (1) sp^3 – s and $sp^3 – sp^3$
    (2) sp^2 – s and $sp^2 – sp^2$
    (3) sp – s and sp – sp
    (4) p – s and p – p

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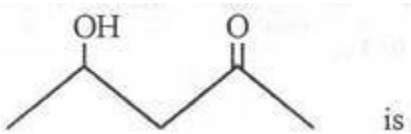
43. The IUPAC name of



is

(1) 4-Hydroxy-2-pentanone
(2) 2-Hydroxy-4-pentanone
(3) 2-Oxo-4-pentanol
(4) 4-Keto-2-pentanol

44. A first order reaction is 60% complete in 20 minutes. How long will the reaction take to be 84% complete?
(1) 54 mins
(2) 68 mins
(3) 40 mins
(4) 76 mins

45. A given sample of milk turns sour at room temperature (27°C) in 5 hours. In a refrigerator at –3°C, it can be stored 10 times longer. The energy of activation for the souring of milk is
(1) 2.303×10 R kJ. mol^{-1}
(2) 2.303×5 R kJ. mol^{-1}
(3) 2.303×3 R kJ. mol^{-1}
(4) 2.303×2.7 R kJ. mol^{-1}

46. At 300 K, a gaseous reaction:
$A \rightarrow B + C$
was found to follow first order kinetics. Starting with pure A, the total pressure at the end of 20 minutes was 100 mm of Hg. The total pressure after the completion of the reaction is 180 mm of Hg. The partial pressure of A (in mm of Hg) is
(1) 100
(2) 90
(3) 180
(4) 80

47. From the Ellingham graphs on carbon, which of the following statements is FALSE?
(1) CO_2 is more stable than CO at less than 983 K
(2) CO reduces Fe_2O_3 to Fe at less than 983 K
(3) CO is less stable than CO_2 at more than 983 K
(4) CO reduces Fe_2O_3 to Fe in the reduction zone of Blast furnace

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48. Which of the following is a negatively charged bidentate ligand?
    (1) Dimethyl glyoximato
    (2) Cyano
    (3) Ethylene diamine
    (4) Acetato

49. The secondary valency of platinum in tetra ammine dichloroplatinum (IV) chloride is
    (1) + 4
    (2) + 2
    (3) 3
    (4) 6

50. Which one of the following has a magnetic moment of 1.75 BM?
    (1) Ti^{3+}
    (2) V^{3+}
    (3) Cr^{3+}
    (4) Fe^{3+}

51. The correct order of ionization energy of C, N, O & F is
    (1) F < N < C < O
    (2) C < N < O < F
    (3) C < O < N < F
    (4) F < O < N < C

52. The correct set of four quantum numbers for the outermost electron of sodium (Z = 11) is
    (1) 3, 1, 0, 1/2
    (2) 3, 1, 1, 1/2
    (3) 3, 2, 1, 1/2
    (4) 3, 0, 0, 1/2

53. The ore that is concentrated by the Froth Floatation process is
    (1) Chalcopyrites
    (2) Cryolite
    (3) Cuprite
    (4) Calmine

54. The equivalent mass of a certain bivalent metal is 20. The molecular mass of its anhydrous chloride is
    (1) 91
    (2) 111
    (3) 55.5
    (4) 75.5

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55. 2 moles of $N_2O_{4(g)}$ is kept in a closed container at 298 K and under 1 atm pressure. It is heated to 596 K when 20% by mass of $N_2O_{4(g)}$ decomposes to NO_2. The resulting pressure is
    (1) 2.4 atm
    (2) 1.2 atm
    (3) 4.8 atm
    (4) 2.8 atm

56. Sucrose is NOT a reducing sugar since
    (1) it is chemically stable
    (2) it contains no free aldehyde or keto group adjacent to a $\diagdown\!\!\diagup$CHOH group
    (3) it is built up of a fructose unit
    (4) it is optically active

57. Which one of the following contains ionic, covalent and co-ordinate bonds?
    (1) NaOH
    (2) NaCl
    (3) NaCN
    (4) NaNC

58. Dialysis can be used to separate
    (1) glucose & fructose
    (2) protein & starch
    (3) glucose & protein
    (4) glucose & NaCl

59. The percentage of p-character of the hybrid orbitals in graphite and diamond are respectively:
    (1) 33 and 25
    (2) 50 and 75
    (3) 67 and 75
    (4) 33 and 75

60. A gas expands from a volume of 1 m^3 to a volume of 2 m^3 against an external pressure of 10^5 Nm^{-2}. The work done by the gas will be
    (1) 10^5 kJ
    (2) 10^2 kJ
    (3) 10^2 kJ
    (4) 10^3 J

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MATHEMATICS

1. Which of the following is incorrect?
   If a = b (mod m) and x is an integer, then
   (1) (a + x) = (b + x) (mod m)
   (2) (a - x) = (b - x) (mod m)
   (3) ax = bx (mod m)
   (4) (a ÷ x) = (b ÷ x) (mod m)

2. Inverse of a diagonal non-singular matrix is
   (1) scalar matrix
   (2) skew symmetric matrix
   (3) zero matrix
   (4) diagonal matrix

3. If $ax^4 + bx^3 + cx^2 + dx + e =$
   $\begin{vmatrix} x^3+3x & x-1 & x+3 \\ x+1 & -2x & x-4 \\ x-3 & x+4 & 3x \end{vmatrix}$, then e =
   (1) 1
   (2) 0
   (3) 2
   (4) – 1

4. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three non-coplanar vectors and $\vec{p}, \vec{q}$ and $\vec{r}$ are vectors defined by
   $\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a}\ \vec{b}\ \vec{c}]}, \vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a}\ \vec{b}\ \vec{c}]}$ and $\vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, then the value of $(\vec{a} + \vec{b}).\vec{p} + (\vec{b} + \vec{c}).\vec{q} +$
   $(\vec{c} + \vec{a}).\vec{r} =$
   (1) 0
   (2) 1
   (3) 2
   (4) 3

5. If $(\vec{a} \times \vec{b})^2 + (\vec{a}.\vec{b})^2 = 144$ and $|\vec{a}| = 4$, then $|\vec{b}| =$
   (1) 16
   (2) 8
   (3) 3
   (4) 12

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6. Which of the following is false?
   (1) (N, *) is a group.
   (2) (N, +) is a semi-group.
   (3) (Z, +) is a group.
   (4) Set of even integers is a group under usual addition

7. $2\cos^{-1}x = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$ is valid for all values of x satisfying
   (1) $-1 \le x \le 1$
   (2) $0 \le x \le 1$
   (3) $1/\sqrt{2} \le x \le 1$
   (4) $0 \le x \le 1/\sqrt{2}$

8. If α is a complex number such that $\alpha^2 - \alpha + 1 = 0$, than α^{2011} =
   (1) $-\alpha$
   (2) α^2
   (3) α
   (4) 1

9. If $\cos\alpha + 2\cos\beta + 3\cos\gamma = 0$, $\sin\alpha + 2\sin\beta + 3\sin\gamma = 0$ and $\alpha + \beta + \gamma = \pi$, then $\sin 3\alpha + 8\sin 3\beta + 27\sin 3\gamma$ =
   (1) -18
   (2) 0
   (3) 3
   (4) 9

10. If the conjugate of $(x + iy)(x + iy)(1 - 2i)$ is $1 + I$, then
   (1) $x - iy = \frac{1+i}{1-2i}$
   (2) $x + iy = \frac{1-i}{1-2i}$
   (3) $x = \frac{1}{5}$
   (4) $x = -\frac{1}{5}$

11. If the straight line $3x + 4y = k$ touches the circle $x^2 + y^2 = 16x$, then the value of k is
   (1) 16, 64
   (2) – 16, - 64
   (3) – 16, 64
   (4) 16, - 64

12. The locus of the point of intersection of perpendicular tangents to the ellipse is called
   (1) hyperbola
   (2) ellipse
   (3) auxiliary circle

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(4) director circle

13. If $m \sin^{-1} x = \log_e y$, then $(1 - x^2) y'' - xy' =$
    (1) m^2y
    (2) $-m^2y$
    (3) $2y$
    (4) $-2y$

14. If $y = e^{\log e[1 + x + x2 + ...]}$, then dy/dt =
    (1) $\frac{1}{(1+x)^2}$
    (2) $\frac{1}{(1-x)^2}$
    (3) $\frac{-1}{(1+x)^2}$
    (4) $\frac{-1}{(1-x)^2}$

15. Length of the subtangent at (x_1, y_1) on $x^n y^m = a^{m+n}$, m, n > 0, is
    (1) $\frac{n}{m} x_1$
    (2) $\frac{m}{n} |x_1|$
    (3) $\frac{n}{m} |y_1|$
    (4) $\frac{n}{m} |x_1|$

16. If a ball is thrown vertically upwards and the height 's' reached in time 't' is given by $s = 22 t - 11 t^2$, then the total distance travelled by the ball is
    (1) 44 units
    (2) 33 units
    (3) 11 units
    (4) 22 units

17. The sum of two positive numbers is given. If the sum of their cubes is minimum, then
    (1) they are equal
    (2) one is twice the other
    (3) they are unequal
    (4) one is thrice the other

18. $\int_{\pi/6}^{\pi/3} \frac{\sin^3 x}{\sin^3 x + \cos^3 x} dx =$
    (1) π/2
    (2) π/3
    (3) π/12
    (4) π/6

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19. $\frac{It}{x\to 0}\frac{x\,2^x-x}{1-\cos x} =$
    (1) 2 log 2
    (2) log 2
    (3) 1/2 log 2
    (4) 1/2

20. If $\frac{3x+1}{(x-1)(x+3)} = \frac{A}{x-1} + \frac{B}{x+3}$, then $\sin^{-1}\frac{A}{B} =$
    (1) π/2
    (2) π/3
    (3) π/6
    (4) π/4

21. If α, ß, γ are the roots of the equation x3+4x+2 = 0, then $\alpha^3 + ß^3 + \gamma^3$ =
    (1) 2
    (2) 6
    (3) – 2
    (4) – 6

22. The value of $^{10}C_1 + {}^{10}C_2 + {}^{10}C_3 + \ldots\ldots + {}^{10}C_9$ is
    (1) 2^{10}
    (2) 2^{11}
    (3) $2^{10} - 2$
    (4) $2^{10} - 1$

23. p → ~q can also be written as
    (1) p → q
    (2) ~ p v ~ q
    (3) q → p
    (4) ~q → ~P

24. If f : IR → IR is defined by f(x) = 2x + 3, then $f^{-1}(x)$
    (1) is given by $\frac{x-3}{2}$
    (2) is given by $\frac{1}{2x+3}$
    (3) does not exist because 'f' is not injective
    (4) does not exist because 'f' is not surjective

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25. $\frac{\sin 70°+\cos 40°}{\cos 70°+\sin 40°} =$
    (1) $\frac{1}{\sqrt{3}}$
    (2) $\sqrt{3}$
    (3) 1/2
    (4) 1

26. The points (11, 9), (2, 1) and (2, -1) are the midpoints of the sides of the triangle. Then the centroid is
    (1) (-5, -3)
    (2) (5, -3)
    (3) (3, 5)
    (4) (5, 3)

27. The reflection of the point (1, 1) along the line y = -x is
    (1) (0, 0)
    (2) (-1, 1)
    (3) (-1, -1)
    (4) (1, -1)

28. The number of circles that touch the co-ordinate axes and the line whose slope is -1 and y-intercept is 1, is
    (1) 1
    (2) 4
    (3) 2
    (4) 3

29. If f(x) is an even function, then f'(x) is
    (1) an odd function
    (2) an even function
    (3) may be even or may be odd
    (4) nothing can be said

30. The perimeter of a sector is a constant. If its area is to be maximum, then the sectorial angle is
    (1) $\pi^c/6$
    (2) $\pi^c/4$
    (3) 4^c
    (4) 2^c

31. The last digit of number 7^{886} is
    (1) 9
    (2) 7
    (3) 3

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(4) 1

32. If (24, 92) = 24 m + 92 n, then (m, n) is
    (1) (-1, 4)
    (2) (4, -1)
    (3) (4, -3)
    (4) (-4, 3)

33. The characteristic equation of a matrix A is $\lambda^3 - 5\lambda^2 - 3\lambda + 2 = 0$ then $|\text{adj } (A)| =$
    (1) 9
    (2) 25
    (3) 1/2
    (4) 4

34. If $\hat{i} + \hat{j} - \hat{k}$ and $2\hat{i} - 3\hat{j} + \hat{k}$ are adjacent sides of a parallelogram, then the lengths of its diagonals are
    (1) √3, √14
    (2) √13, √14
    (3) √21, √3
    (4) √21, √13

35. If the volume of the parallelepiped formed by three non-coplanar $\hat{a}, \hat{b}$ and $\hat{c}$ is 4 cubic units, then $[\hat{a} \times \hat{b} \quad \hat{b} \times \hat{c} \quad \hat{c} \times \hat{a}] =$
    (1) 64
    (2) 16
    (3) 4
    (4) 8

36. Which of the following is a subgroup of the group $G = \{2^n | n \in Z|$ under multiplication?
    (1) $\{4^n | n \in\}$
    (2) $\{3^n | n \in Z\}$
    (3) $\{6^n | n \in N\}$
    (4) $\{4^n | n \in Z\}$

37. In the group G = {1, 2, 3, 4, 5, 6} under $\otimes_7$, the solution of $4 \otimes_7 x = 5$ is
    (1) 3
    (2) 2
    (3) 4
    (4) 5

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38. The number of real solutions of the equation $\tan^1\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$ is
    (1) one
    (2) four
    (3) two
    (4) infinitely many

39. If sin 2x = 4 cos x, then x = --------
    (1) $n\frac{\pi}{2} \pm \frac{\pi}{4}, n \in Z$
    (2) no value
    (3) $n\pi + (-1)^n \frac{\pi}{4} n \in Z$
    (4) $2n\pi \pm \frac{\pi}{2}, n \in Z$

40. If α and ß are different complex numbers with |ß|= 1, then $\left|\frac{ß-\alpha}{1-\bar{\alpha}ß}\right|$ is equal to
    (1) 1/2
    (2) 1
    (3) 1/3
    (4) 2

41. The equations of the two tangents from (-5, -4) to the circle $x^2 + y^2 + 4s + 6y + 8 = 0$ are
    (1) x + 2y + 13 = 0, 2x- y + 6 =0
    (2) 2x + y + 13 = 0, x – 2y = 6
    (3) 3x+2y + 23 = 0, 2x – 3y + 4 = 0
    (4) x – 7y = 23, 6x + 13y = 4

42. If $x = t^2 + 2$ and y = 2t represent the parametric equation of the parabola
    (1) $x^2 = 4(y - 2)$
    (2) $(y - 2)^2 = 4x$
    (3) $y^2 = 4 (x - 2)$
    (4) $(x - 2)^2 = 4y$

43. If x – y = 1 is a tangent to the hyperbola $\frac{x^2}{4} - \frac{y^2}{3} = 1$, the point of contact is
    (1) (4, 3)
    (2) (3, 4)
    (3) (2, 1)
    (4) (5, 4)

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44. If $y = \tan^{-1}\left(\frac{1}{1+x+x^2}\right) + \tan^{-1}\left(\frac{1}{x^2+2x+3}\right) + \tan^{-1}\left(\frac{1}{x^2+5x+7}\right) + \cdots + n$ terms, then $y'(0)$ is
    (1) $\frac{\pi}{2}$
    (2) $\frac{2n}{1+n^2}$
    (3) $\frac{n^2}{1+n^2}$
    (4) $-\frac{n^2}{1+n^2}$

45. If $f(x) = \sin[\pi^2]x + \cos[-\pi^2]x$ then $f'(x)$ is, here $[\pi^2]$ and $[-\pi^2]$ greatest integer function not greater than its value
    (1) sin 9x + cos 9x
    (2) 9 cos 9x – 10 sin 10x
    (3) 0
    (4) -1

46. The tangent to the curve xy = 25 at any point on it cuts the coordinate axes at A and B, then the area of the triangle OAB is
    (1) 50 sq. units
    (2) 25 sq. units
    (3) 75 sq. units
    (4) 100 sq. units

47. The length of the sub-tangent, ordinate and the sub-normal are in
    (1) A.P.
    (2) H.P.
    (3) G.P.
    (4) Arithmetico geometric procession

48. The maximum value of xe^{-x} is
    (1) e
    (2) 1/e
    (3) –e
    (4) -1/e

49. If [x] is the greatest integer function not greater than x, then $\int_0^{11}[x]dx =$
    (1) 45
    (2) 66
    (3) 35

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(4) 55

50. If $n \in N$ and $I_n = \int (\log x)^n \, dx$, then $I_n + nI_{n-1} =$
(1) $\frac{(\log x)^{n+1}}{n+1}$
(2) $x\,(\log x)^n + c$
(3) $(\log x^{n-1})$
(4) $\frac{(\log\ x)^n}{n}$

51. Solution of $e^{\frac{dy}{dx}} = x$ when $x = 1$ and $y = 0$ is
(1) $y = x\,(\log x - 1) + 4$
(2) $y = x\,(\log x - 1) + 3$
(3) $y = x\,(\log x + 1) + 1$
(4) $y =\ x\,(\log x - 1) + 1$

52. If $f(x) = \begin{cases} x^2 - (a+2)x + a & x \neq 2 \\ 2 & x = 2 \end{cases}$ is continuous at $x = 2$, then the value of a is
(1) - 6
(2) 0
(3) 1
(4) – 1

53. If $\log_2 (9^{x-1} + 7) - \log_2 (3^{x-1} + 1) = 2$, then x values are
(1) 0, 2
(2) 0, 1
(3) 1, 4
(4) 1, 2

54. If x – 1 is a factor of $x^5 - 4x^3 + 2x^2 - 3k + K = 0$, then k is
(1) 4
(2) – 4
(3) 2
(4) 3

55. If A and B have n elements in common, then the number of elements common to A × B and B × A is
(1) n
(2) 2n
(3) n^2
(4) 0

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56. The 13th term in expansion of $\left(x^2 + \frac{1}{x}\right)$ is independent of x then the sum of the divisors of n is
    (1) 36
    (2) 37
    (3) 38
    (4) 39

57. If one of the slopes of the pair of lines $ax^2 + 2hxy + by^2 = 0$ is n times the other then
    (1) $4(n + 1)^2ab = nab$
    (2) $4h^2 = (n + 1)^2ab$
    (3) $4nh^2 = (n + 1)^2 ab$
    (4) $4ab = (n + 1)^2 h$

58. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & x \end{vmatrix}$ then $\lim_{x \to 0} \frac{f(x)}{x^2} =$
    (1) 0
    (2) 3
    (3) 2
    (4) 1

59. The number of solutions of the equation $z^2 + \bar{z} = 0$ where $z \in C$ are
    (1) 1
    (2) 4
    (3) 5
    (4) 6

60. The least and the greatest distance of the point (10, 7) from the circle $x^2 + y^2 - 4x - 2y - 20 = 0$ are
    (1) 10, 5
    (2) 15, 20
    (3) 12, 16
    (4) 5, 15