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COMMON ENTRANCE TEST – 2009

PHYSICS

1. The number of significant figures in the numbers 4.8000×10^4 and 48000.50 are respectively
   (1) 5 and 7
   (2) 2 and 7
   (3) 2 and 6
   (4) 5 and 6

2. ß-decay means emission of electron from
   (1) a stable nucleus
   (2) outermost electron orbit
   (3) radioactive nucleus
   (4) innermost electron orbit

3. An electric heart rated 220 V and 550 W is connected to A.C. mains. The current drawn by it is
   (1) 2.5 A
   (2) 0.4 A
   (3) 1.25 A
   (4) 0.8 A

4. A body of mass 'm' moving along a straight line covers half the distance with a speed of 2 ms^{-1}. The remaining half of the distance is covered in two equal time intervals with a speed of 3 ms^{-1} and 5 ms^{-1} respectively. The average speed of the particle for the entire journey is
   (1) 8/5 ms^{-1}
   (2) 4/3 ms^{-1}
   (3) 16/3 ms^{-1}
   (4) 3/8 ms^{-1}

5. The moment of inertia of a circular ring of radius 'r' and mass 'M' about diameter is
   (1) $Mr^2/4$
   (2) $Mr^2/2$
   (3) $Mr^2/12$
   (4) $2/5\ Mr^2$

6. A body of mass 0.05 kg is observed to fall with an acceleration of 9.5 ms^{-2}. The opposing force of air on the body is _____ (g = 9.8 ms^{-2}).
   (1) 0.15 N
   (2) 0.030 N
   (3) Zero
   (4) 0.015 N

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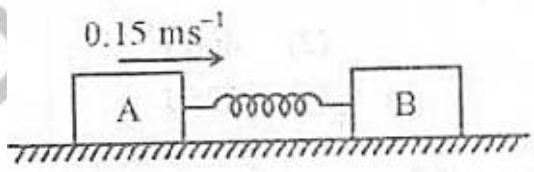
7. The colloidal solution in which both the dispersed phase and dispersion medium are liquids called
   (1) gels
   (2) foams
   (3) liquid crystals
   (4) emulsions

8. In fog, photographs of the objects taken with infra-red radiations are more clear than those obtained during visible light because
   (1) scattering of I-R light is more than visible light
   (2) the intensity of I-R light the object is less
   (3) scattering of I-R light is less than visible light
   (4) I-R radiation has lesser wavelength than visible radiation

9. Three concurrent co-planar forces 1 N, 2 N and 3N acting along different directions on a body
   (1) can keep the body in equilibrium if 1 N and 2 N act at right angles.
   (2) cannot keep the body in equilibrium.
   (3) can keep the body in equilibrium if 1 N and 3 N act at an acute angle.
   (4) can keep the body in equilibrium if 2 N and 3 N act at right angles.

10. Sound waves transfer
    (1) energy
    (2) momentum
    (3) both energy and momentum
    (4) only energy not momentum

11. Two rectangular blocks A and B of masses 2 kg and 3 kg respectively are connected by a spring of spring constant 10.8 Nm^{-1} are placed on a frictionless horizontal surface. The block 'A' was given an initial velocity of 0.15 ms^{-1} in in the direction shown in the figure. The maximum compression of the spring during the motion is



    (1) 0.02 m
    (2) 0.05 m
    (3) 0.03 m
    (4) 0.01 m

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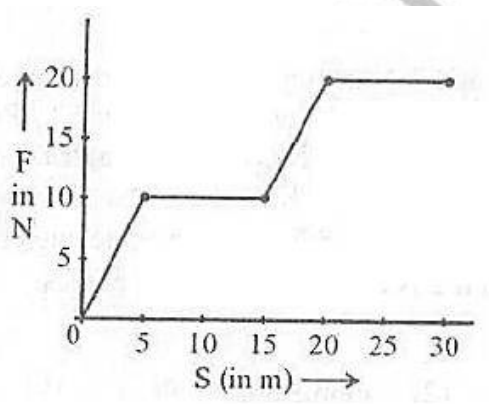
12. G.P. Thomson experimentally confirmed the existence of matter waves by the phenomena
    (1) refraction
    (2) polarisation
    (3) scattering
    (4) diffraction

13. The resistance of a wire at 300 K is found to be 0.3 Ω. If the temperature co-efficient of resistance of wire is $1.5 \times 10^{-3}\ K^{-1}$, the temperature at which the resistance becomes 0.6 Ω is
    (1) 345 K
    (2) 993 K
    (3) 690 K
    (4) 720 K

14. The work done by a force acting on a body is as shown in the graph. The total work done in covering an initial distance of 20 m is



    (1) 200 J
    (2) 400 J
    (3) 175 J
    (4) 225 J

15. Two luminous point sources separated by a certain distance are at 10 km from an observer. If the aperture of his eye is 2.5×10^{-3} m and the wavelength of light used is 500 nm, the distance of separation between the point sources are just seen to be resolved is
    (1) 24.4 m
    (2) 2.44 m
    (3) 1.22 m
    (4) 12.2 m

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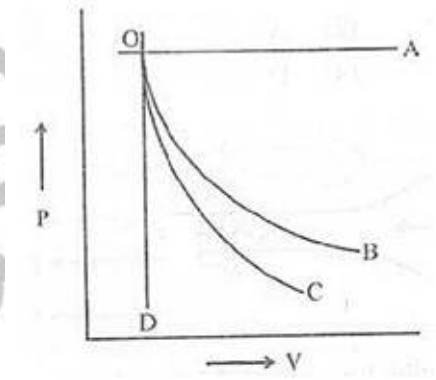
16. A door of 1.6 m wide requires a force of 1 N to be applied at the free end to open or close it. The force that is required at a point 0.4 m distance from the hinges for opening or closing the door is
    (1) 3.6 N
    (2) 2.4 N
    (3) 4 N
    (4) 1.2 N

17. 0.1 m^3 of water at 80°C is mixed with 0.3 m^3 of water at 60°C. The final temperature of the mixture is
    (1) 70°C
    (2) 60°C
    (3) 75°C
    (4) 65°C

18. The spectral series of the hydrogen atom that lies in the visible region of the electromagnetic spectrum
    (1) Balmer
    (2) Lyman
    (3) Backett
    (4) Paschen

19. A graph of pressure versue volume for an ideal gas for different process is as shown. In the graph curve OC represents



    (1) isothermal process
    (2) isobaric process
    (3) adiabatic process
    (4) isochoric process

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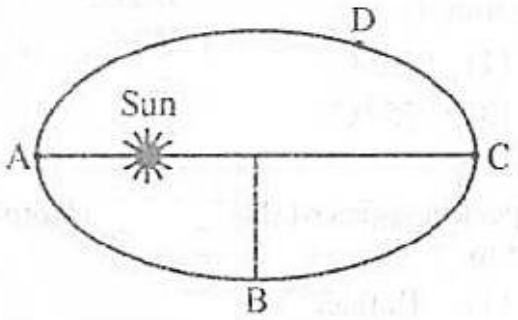
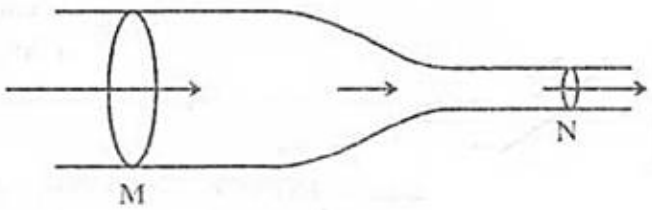
20. Which of the following statement does not hold good for thermal radiation?
    (1) The frequency changes when it travels from one medium to another.
    (2) The speed changes when it travels from one medium to another.
    (3) They travel in straight line in a given medium.
    (4) The wavelength changes when it travels from one medium to another.

21. A planet revolves round the Sun in an elliptical orbit. The linear speed of the planet will be maximum at



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

22. Horizontal tube of non-uniform cross-section has radii of 0.1 m and 0.05 m respectively at M and N. For a streamline flow of liquid the rate of liquid flow is



    (1) greater at M than at N
    (2) greater at N than at M
    (3) same at M and N
    (4) continuously changes with time

23. A resistor and a capacitor are connected in series with an a.c. source. If the potential drop across the capacitor is 5 V and that across resistor is 12 V, the applied voltage is
    (1) 17 V
    (2) 5 V
    (3) 12 V
    (4) 13 V

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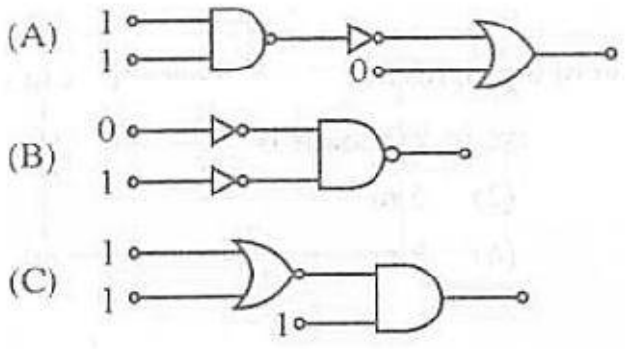
24. The amount of heat energy radiated by a metal at temperature 'T' is 'E'. When the temperature is increased to 3T, energy radiated is
    (1) 9 E
    (2) 3 E
    (3) 27 E
    (4) 81 E

25. The angle of minimum deviation for an incident light ray on an equilateral prism is equal to its refracting angle. The refractive index of its material is
    (1) $\sqrt{3}$
    (2) $\sqrt{3}/2$
    (3) $3/2$
    (4) $\frac{1}{\sqrt{2}}$

26. In the following combination of logic gates, the outputs of A, B and C are respectively



    (1) 0, 1, 0
    (2) 1, 1, 0
    (3) 1, 0, 1
    (4) 0, 1, 1

27. A stationary point source of sound emits sound uniformly in all directions in a non-absorbing medium. Two points P and Q are at a distance of 4 m and 9 m respectively from the source. The ratio of amplitudes of the waves at P & Q is
    (1) 4/9
    (2) 2/3
    (3) 9/4
    (4) 3/2

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28. A galvanometer of resistance 240 Ω allows only 4% of the main current after connecting a shunt resistance. The value of the shunt resistance is
    (1) 20 Ω
    (2) 8 Ω
    (3) 5 Ω
    (4) 10 Ω

29. The phenomena in which proton flips is
    (1) lasers
    (2) radioactivity
    (3) nuclear fusion
    (4) nuclear magnetic resonance

30. $y = 3 \sin \pi (1/2 - x/4)$ represents an equation of a progressive wave, where 't' is in second and 'x' is in metre. The distance travelled by the wave in 5 seconds is
    (1) 10 m
    (2) 5 m
    (3) 32 m
    (4) 8 m

31. According to the quark model, it is possible to build all the hadrons using
    (1) 3 quarks and 2 antiquarks
    (2) 3 quarks and 3 antiquarks
    (3) 2 quarks and 2 antiquarks
    (4) 2 quarks and 3 antiquarks

32. An α-particle of mass 6.4×10^{-27} kg and charge 3.2×10^{-19} C is situated in a uniform electric field of 1.6×10^{5} V m^{-1}. The velocity of the particle at the end of 2×10^{-2} m path when it starts from rest is
    (1) 8×10^{5} ms^{-1}
    (2) 16×10^{5} ms^{-1}
    (3) $4\sqrt{2} \times 10^{5}\ ms^{-1}$
    (4) $2\sqrt{3} \times 10^{5}\ ms^{-1}$

33. A cylindrical tube open at both the ends has a fundamental frequency of 390 Hz in air. If $1/4^{th}$ of the tube is immersed vertically in water the fundamental frequency of air column is
    (1) 130 Hz
    (2) 390 Hz
    (3) 520 Hz
    (4) 260 Hz

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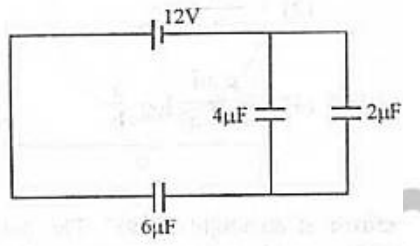
34. The surface temperature of the stars is determined using
    (1) Wein's displacement law
    (2) Rayleigh-Jeans law
    (3) Kirchoff's law
    (4) Planck's law

35. The charge deposited on 4μF capacitor in the circuit is



    (1) 12×10^{-6} C
    (2) 24×10^{-6} C
    (3) 36×10^{-6} C
    (4) 6×10^{-6} C

36. A parallel beam of light is incident on a converging lens parallel to its principal axis. As one moves away from the lens on the other side of the principal axis, the intensity of light
    (1) continuously increases
    (2) continuously decreases
    (3) first increases and then decreases
    (4) first decreases and then increases

37. Continuous emission spectrum is produced by
    (1) Mercury vapour lamp
    (2) Sodium vapour lamp
    (3) The sun
    (4) Incandescent electric lamp

38. A coil of 'n' number of turns is wound tightly in the form of a spiral with inner and outer radii 'a' and 'b' respectively. When a current of strength I is passed through the coil, the magnetic field at its centre is
    (1) $\frac{\mu_0 nI}{2(b-a)}$
    (2) $\frac{2\mu_0 nI}{b}$
    (3) $\frac{\mu_0 nI}{2(b-a)} \log_e \frac{b}{a}$
    (4) $\frac{\mu_0 nI}{(b-a)} \log_e \frac{a}{b}$

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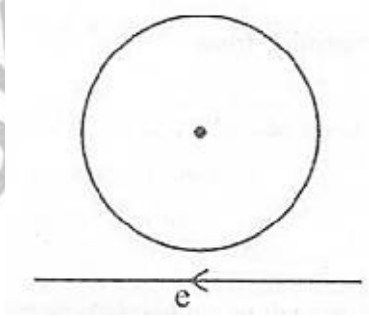
39. A ray of light is incident on a plane mirror at an angle of 60°. The angle of deviation produced by the mirror is
    (1) 30°
    (2) 60°
    (3) 90°
    (4) 120°

40. The electric potential at any point x, y, z in metres is given by $V = 3x^2$. The electric field at a point (2m, 0.1m) is
    (1) $-6\ \mathrm{V\ m^{-1}}$
    (2) $6\ \mathrm{V\ m^{-1}}$
    (3) $-12\ \mathrm{Vm^{-1}}$
    (4) $12\ \mathrm{Vm^{-1}}$

41. Young's double slit experiment gives interference fringes of width 0.3 mm. A thin glass plate made of material of refractive index 1.5 is kept in the path of light from one of the slits, then the fringe width becomes
    (1) 0.3 mm
    (2) 0.45 mm
    (3) 0.15 mm
    (4) Zero

42. Near a circular loop of conducting wire as shown in the figure an electron moves along a straight line. The direction of the induced current if any in the loop is



    (1) clockwise
    (2) anticlockwise
    (3) zero
    (4) variable

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43. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, the principal quantum number 'n' of the excited state is
    (1) $\sqrt{\frac{\lambda}{\lambda R-1}}$
    (2) $\sqrt{\frac{\lambda R^2}{\lambda R-1}}$
    (3) $\sqrt{\frac{\lambda R}{\lambda-1}}$
    (4) $\sqrt{\frac{\lambda R}{\lambda R-1}}$

44. The magnetic dipole moment of a current loop is independent of
    (1) number of turns
    (2) area of the loop
    (3) current in the loop
    (4) magnetic field in which it is lying

45. In ruby laser, the stimulated emission is due to transition from
    (1) any higher state to lower state
    (2) metastable state to ground state
    (3) any higher state to ground state
    (4) metastable state to any lower state

46. A direct current I flows along the length of an infinitely long straight thin walled pipe, then the magnetic field
    (1) is zero only along the axis of the pipe
    (2) is zero at any point inside the pipe
    (3) is maximum at the centre and minimum at the edges
    (4) is uniform throughout the pipe but not zero

47. A convex lens made of glass has focal length 0.15 m in air. If the refractive index of glass is 3/2 and that of water is 4/3, the focal length of lens when immersed in water is
    (1) 0.15 m
    (2) 0.30 m
    (3) 0.6 m
    (4) 0.45 m

48. Two sources are said to be coherent if they produce waves
    (1) of equal wavelength
    (2) of equal speed
    (3) having same shape of wave front
    (4) having a constant phase difference

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49. Three resistors 1 Ω, 2 Ω and 3 Ω are connected to form a triangle. Across 3 Ω resistor a 3 V battery is connected. The current through 3 Ω resistor is
    (1) 1 A
    (2) 2 A
    (3) 1.5 A
    (4) 0.75 A

50. In a common emitter amplifier the input signal is applied across
    (1) emitter – collector
    (2) collector – base
    (3) base – emitter
    (4) anywhere

51. In a radioactive disintegration, the ratio of initial number of atoms to the number of atoms present at an instant of time equal to its mean life is
    (1) 1/e
    (2) e
    (3) e^2
    (4) $1/e^2$

52. A ray of light is incident on a surface of glass slab at an angle 45°. If the lateral shift produced per unit thickness is 1/√3 m, the angle of refraction produced is
    (1) $\tan^{-1}\left(1-\sqrt{\frac{2}{3}}\right)$
    (2) $\sin^{-1}\left(1-\sqrt{\frac{2}{3}}\right)$
    (3) $\tan^{-1}\left(\sqrt{\frac{2}{\sqrt{3}-1}}\right)$
    (4) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

53. Ferromagnetic materials used in a transformer must have
    (1) higher permeability and low hysterisis loss
    (2) higher permeability and high hysterisis loss
    (3) low permeability and low hysterisis loss
    (4) low permeability and high hysterisis loss

54. According to Newton's Corpuscular Theory, the speed of light is
    (1) lesser in rarer medium
    (2) lesser in denser medium
    (3) independent of the medium
    (4) same in all the media

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55. For the constructive interference the path difference between the two interfering waves must be equal to
    (1) $2n\pi$
    (2) $n\lambda$
    (3) $(2n + 1)\lambda/2$
    (4) $(2n + 1)\lambda$

56. The accurate measurement of emf can be obtained using
    (1) Voltmeter
    (2) Voltameter
    (3) Potentiometer
    (4) Multimeter

57. The kinetic energy of an electron gets tripled, then the de-Broglie wavelength associated with it changes by a factor
    (1) $\sqrt{3}$
    (2) $1/\sqrt{3}$
    (3) 3
    (4) 1/3

58. Which of the following is not a thermodynamic co-ordiante?
    (1) Pressure (P)
    (2) Volume (V)
    (3) Temperature (T)
    (4) Gas constant (R)

59. Two solid pieces, one of steel and the other of aluminium when immersed completely in water have equal weights. When the solid pieces are weighted in air
    (1) steel piece will weigh more
    (2) they have the same weight
    (3) aluminium piece will weigh more
    (4) the weight of aluminium is half the weight of steel

60. The amount of energy releases when one microgram of matter is annihilated is
    (1) 9×10^{10} kWh
    (2) 3×10^{10} kWh
    (3) 0.5×10^{5} kWh
    (4) 0.25×10^{5} kWh

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CHEMISTRY

1. The ore that is connected by Froth Floatation process is
   (1) Bauxite
   (2) Malachite
   (3) Zincite
   (4) Cinnabar

2. The correct set of four Quantum numbers for outermost electron of Potassium (Z = 19) is
   (1) 4, 0, 0, 1/2
   (2) 3, 0, 0, 1/2
   (3) 4, 1, 0, 1/2
   (4) 3, 1, 0, 1/2

3. A body of mass x kg is moving with a velocity of 100 ms^{-1}. Its de Broglie wavelength is 6.62×10^{-35} m. Hence x is ($h = 6.62 \times 10^{-34}$ Js)
   (1) 0.15 kg
   (2) 0.2 kg
   (3) 0.1 kg
   (4) 0.25 kg

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

5. The oxide of an element whose electronic configuration is $1s^2\ 2s^2\ 2p^6\ 3s^1$ is
   (1) Basic
   (2) Acidic
   (3) Neutral
   (4) Amphoteric

6. The characteristic not related to alkali metal is
   (1) low melting point
   (2) low electronegativity
   (3) high ionization energy
   (4) their ions are isoelectronic with noble gases

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7. Among the following, the compound that contains ionic, covalent and coordinate linkage is
   (1) NaCl
   (2) CaO
   (3) NH_3
   (4) NH_4Cl

8. A covalent molecule AB_3 has pyramidal structure. The number of lone pair and bond pair electrons in the molecule are respectively
   (1) 3 and 1
   (2) 1 and 3
   (3) 2 and 2
   (4) 0 and 4

9. Excess of carbon dioxide is passed through 50 ml of 0.5 M calcium hydroxide solution. After the completion of the reaction, the solution was evaporated to dryness. The solid calcium carbon was completely neutralized with 0.1 N Hydrochloric acid. The volume of Hydrochloric acid required is (At. Mass of calcium = 40)
   (1) 500 cm^3
   (2) 400 cm^3
   (3) 300 cm^3
   (4) 200 cm^3

10. A bivalent metal has an equivalent mass of 32. The molecular mass of the metal nitrate is
   (1) 192
   (2) 188
   (3) 182
   (4) 168

11. The r.m.s. velocity of molecules of a gas of density 4 kg m^{-3} and pressure 1.2×10^5 Nm^{-2} is
   (1) 120 ms^{-1}
   (2) 600 ms^{-1}
   (3) 300 ms^{-1}
   (4) 900 ms^{-1}

12. 0.5 mole of each of H_2, SO_2 and CH_4 are kept in a container. A hole was made in the container. After 3 hours, the order of partial pressures in the container will be
   (1) $pH_2 > pSO_2 > pCH_4$
   (2) $pH_2 > pCH_4 > pSO_2$
   (3) $pSO_2 > pH_2 > pCH_4$
   (4) $pSO_2 > pCH_4 > pH_2$

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13. The enthalpy of formation of NH_3 is – 64 kJ mol^{-1}. The enthalpy change for the reaction:
$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ is
(1) + 92 kJ
(2) + 46 kJ
(3) + 184 kJ
(4) +23 kJ

14. 5 moles of SO_2 and 5 moles of O_2 are allowed to react. At equilibrium, it was found that 60% of SO_2 is used up. If the partial pressure of the equilibrium mixture is one atmosphere, the partial pressure of O_2 is
(1) 0.21 atm
(2) 0.41 atm
(3) 0.82 atm
(4) 0.52 atm

15. $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$
The equilibrium constant of the above reaction is 6.4 at 300 k. If 025 mole each of H_2 and I_2 are added to the system, the equilibrium constant will be
(1) 3.2
(2) 1.6
(3) 6.4
(4) 0.8

16. Rate of physical adsorption increases with
(1) decrease in pressure
(2) increase in temperature
(3) decrease in surface area
(4) decrease in temperature

17. IUPAC name of $(CH_3)_3$ CCl
(1) 2 chloro 2 methyl propane
(2) t-butyl chloride
(3) n-butyl chloride
(4) 3-chloro butane

18. Lucas test is associated with
(1) Carboxylic acid
(2) Alcohols
(3) Aldehydes
(4) Phenols

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19. An organic compound on heating with CuO produces CO_2 but no water. The organic compound may be
    (1) Methane
    (2) Ethyl iodide
    (3) Carbon tetrachloride
    (4) Chloroform

20. The condensation polymer among the following is
    (1) PVC
    (2) Polyethene
    (3) Rubber
    (4) Protein

21. The order of stability of metal oxides is
    (1) $Fe_2O_3 < Cr_2O_3 < Al_2O_3 < MgO$
    (2) $Fe_2O_3 < Al_2O_3 < Cr_2O_3 < MgO$
    (3) $Al_2O_3 < MgO < Fe_2O_3 < Cr_2O_3$
    (4) $Cr_2O_3 < MgO < Al_2O_3 < Fe_2O_3$

22. The temperature of the slag zone in the metallurgy of Iron using blast furnace is
    (1) 400 – 700 °C
    (2) 800 – 1000 °C
    (3) 1200 – 1500 °C
    (4) 1500 – 1600 °C

23. The function of $Fe(OH)_3$ in the contact process is
    (1) to remove moisture
    (2) to remove dust particles
    (3) to remove arsenic impurity
    (4) to detect colloidal impurity

24. In which of the following, NH_3 is not used?
    (1) Group reagent for the analysis of IV group basic radical.
    (2) Group reagent for the analysis of III group basic radical.
    (3) Tollen's reagent
    (4) Nessler's reagent

25. Argon is used
    (1) in high temperature welding
    (2) in radiotherapy for treatment of cancer
    (3) in falling airships
    (4) to obtain low temperature

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26. The incorrect statement in respect of Chromyl chloride test is
    (1) formation of Chromyl chloride
    (2) liberation of Chlorine
    (3) formation of red vapours
    (4) formation of lead chromate

27. The magnetic moment of a transition metal ion is √15 B.M. Therefor the number of unaired electrons present in it is
    (1) 1
    (2) 2
    (3) 3
    (4) 4

28. The IUPAC name of $[Co(NH_3)_5ONO]^{2+}$ ion is
    (1) Penta ammne nitro cobalt (III) ion
    (2) Penta ammine nitro cobalt (IV) ion
    (3) Penta ammine nitrito cobalt (IV) ion
    (4) Penta ammine nitrito cobalt (III) ion

29. The oxidation state of Fe in the brown ring complex : $[Fe(H_2O)_5\ NO]SO_4$ is
    (1) +2
    (2) +1
    (3) +3
    (4) 0

30. The correct statement with regard to H_2^+ and H_2^- is
    (1) H_2^- is more stable than H_2^+
    (2) H_2^+ is more stable than H_2^-
    (3) Both H_2^+ and H_2^- are equally stable
    (4) Both H_2^+ and H_2^- do not exist

31. Arrange the following in the increasing order of their bond order:
    O_2, O_2^+, O_2^- and O_2^{--}
    (1) $O_2^+, O_2, O_2^-, O_2^{--}$
    (2) $O_2, O_2^+,\ O_2^-, O_2^{--}$
    (3) $O_2^{--}, O_2^-, O_2, O_2^+$
    (4) $O_2^{--}, O_2^-, O_2^+, O_2$

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32. 2 gm of a radioactive sample having half life of 15 days was synthesised on 1st Jan 2009. The amount of the sample left behind on 1st March, 2009 (including both the days)
    (1) 1 gm
    (2) 0.5 gm
    (3) 0 gm
    (4) 0.125 gm

33. For a chemical reaction A → B, the rate of the reaction is 2×10^{-3} mol dm^{-3} s^{-1}. When the initial concentration is 0.05 mol dm^{-3}. The rate of the same reaction is 1.6×10^{-2} mol dm^{-3} s^{-1} when the initial concentration is 0.1 dm^{-3}. The order of the reaction is
    (1) 3
    (2) 1
    (3) 2
    (4) 0

34. For the decomposition of a compound AB at 600 K, the following data were obtained:

[AB] mol dm^{-3}	Rate of decomposition of AB in mol $dm^{-3}s^{-1}$
0.20	2.75×10^{-8}
0.40	11.0×10^{-8}
0.60	24.75×10^{-8}

    The order for the decomposition of AB is
    (1) 1
    (2) 2
    (3) 1.5
    (4) 0

35. The rate equation for a reaction: A → B is r = K[A]°. If the initial concentration of the reactant is a mold dm^{-3}, the half life period of the reaction is
    (1) a/K
    (2) 2a/K
    (3) a/2K
    (4) K/a

36. 30 cc of M/3 HCl, 20 cc of M/2 HNO_3 and 40 cc of M/4 NaOH solutions are mixed and the volume was made up to 1 dm^3. The pH of the resulting solution is
    (1) 1
    (2) 3
    (3) 8
    (4) 2

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37. An aqueous solution containing 6.5 gm of NacL of 90% purity was subjected to electrolysis. After the complete electrolysis, the solution was evaporated to get solid NaOH. The volume of 1 M acetic acid required t neutralize NaOH obtained above is
    (1) 100 cm^3
    (2) 200 cm^3
    (3) 1000 cm^3
    (4) 2000 cm^3

38. The standard electrode potential for the half cell reactions are:
    $Zn^{++} + 2e^- \rightarrow Zn$ E° = - 0.76 V
    $Fe^{++} + 2e^- \rightarrow Fe$ E° = - 0.44 V
    The E.M.F. of the cell reaction:
    $Fe^{++} + Zn \rightarrow Zn^{++} + Fe$ is
    (1) + 1.20 V
    (2) + 0.32 V
    (3) – 0.32 V
    (4) – 120 V

39. 10^6 M NaOH is diluted 100 times. The pH of the diluted base is
    (1) between 6 and 7
    (2) between 10 and 11
    (3) between 7 and 8
    (4) between 5 and 6

40. In the electrolysis acidulated water, it is desired to obtain 1.12 cc of Hydrogen per second under S.T.P. condition. The current to be passed is
    (1) 19.3 Amp
    (2) 0.965 Amp
    (3) 1.93 Amp
    (4) 9.65 Amp

41. The one which decreases with dilution is
    (1) Specific conductance
    (2) Equivalent conductance
    (3) Molar conductance
    (4) Conductance

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42. Vapour pressure of pure 'A' is 70 mm of Hg at 25° C. It forms an ideal solution with 'B' in which mole fraction of A is 0.8. If the vapour pressure of the solution is 84 mm of Hg at 25°C, the vapour pressure of pure 'B' at 25°C is
    (1) 70 mm
    (2) 140 mm
    (3) 28 mm
    (4) 56 mm

43. A 6% solution of urea is isotonic with
    (1) 6% solution of Glucose
    (2) 25% solution of Glucose
    (3) 1 M solution of Glucose
    (4) 0.05 M solution of Glucose

44. In countries nearer to polar region, the roads are sprinkled with $CaCl_2$. This is
    (1) to minimise pollution
    (2) to minimise the accumulation of dust on the road
    (3) to minimise the wear and tear of the roads
    (4) to minimise the snow fall.

45. For the reaction $H_2O(l) \rightleftharpoons H_2O(g)$ at 373 K and one atmospheric pressure
    (1) $\Delta H = T\Delta S$
    (2) $\Delta H = \Delta E$
    (3) $\Delta H = 0$
    (4) $\Delta E = 0$

46. A compound of 'A' and 'B' crystallises in a cubic lattice in which the 'A' atoms occupy the lattice points at the corners of the cube. The 'B' atoms occupy the centre of each face of the cube. The probable empirical formula of the compound is
    (1) AB
    (2) AB_3
    (3) AB_2
    (4) A_3B

47. In electrophilic aromatic substitution reaction, the nitro group is meta directing because it
    (1) increases electron density at meta position
    (2) increases electron density at ortho and para positions
    (3) decreases electron density at ortho and para positions
    (4) decreases electron density at meta position

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48. $CH_3COOH \xrightarrow{LiAlH_4}$

$$X \xrightarrow[300\ ^\circ C]{Cu} Y \xrightarrow[NaOH]{dilute} Z$$

In the above reaction Z is

(1) Ketol
(2) Acetal
(3) Butanol
(4) Aldol

49. The best method for the conversion of an alcohol into an alkyl chloride is by treating the alcohol with

(1) $SOCl_2$ in presence of pyridine
(2) Dry HCl in the presence of anhydrous $ZnCl_2$
(3) PCl_3
(4) PCl_5

50. The electrophile involved in the sulphonation of Benzene is

(1) H_3^+O
(2) SO_3
(3) SO_3^+
(4) SO_3^{--}

51. The carbon-carbon bond length in Benzene is

(1) in between C_2H_6 and C_2H_2
(2) in between C_2H_4 and C_2H_2
(3) in between C_2H_6 and C_2H_4
(4) same as in C_2H_4

52. The compound which is not formed during the dry distillation of a mixture of calcium formate and calcium acetate is

(1) Propanone
(2) Ethanal
(3) Methanal
(4) Propanal

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53. An organic compound X is oxidized by using acidified $K_2Cr_2O_7$. The product obtained reacts with Phenyl hydrazine but does not answer silver mirror test. The possible structure of X is
    (1) $(CH_3)_2CHOH$
    (2) CH_3CHO
    (3) CH_3CH_2OH
    (4) $CH_3 - \underset{\underset{O}{\|}}{C} - CH_3$

54. The reaction involved in the oil of Winter Green test is Salicyclic acid $\xrightarrow[\text{Conc. } H_2SO_4]{\Delta}$ product. The product is treated with Na_2CO_3 solution. The missing reagent in the above reaction is
    (1) Ethanol
    (2) Methanol
    (3) Phenol
    (4) NaOH

55. The compound which forms acetaldehyde when heated with dilute NaOH is
    (1) 1 Chloro ethane
    (2) 1, 2 Dichloro ethane
    (3) 1, 1 Dichloro ethane
    (4) 1, 1, 1 Trichloro ethane

56. Arrange the following in the increasing order of their basic strengths:
    CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$, NH_3
    (1) $(CH_3)_3N < NH_3 < CH_3NH_2 < (CH_3)_2NH$
    (2) $CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N < NH_3$
    (3) $NH_3 < (CH_3)_3N < (CH_3)_2NH < CH_3NH_2$
    (4) $NH_3 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

57. The one which has least Iodine value is
    (1) Ghee
    (2) Groundnut oil
    (3) Sunflower oil
    (4) Ginger oil

58. A diabetic person carries a pocket of Glucose with him always, because
    (1) Glucose reduces the blood sugar level.
    (2) Glucose increases the blood sugar level almost instantaneously.
    (3) Glucose reduces the blood sugar level slowly.
    (4) Glucose increases the blood sugar level slowly.

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59. There are 20 naturally occurring amino acids. The maximum number of tripetides that can be obtained is
    (1) 7465
    (2) 5360
    (3) 8000
    (4) 6470

60. Cooking is fast in a pressure cooker, because
    (1) food is cooked at constant volume.
    (2) loss of heat due to radiation is minimum.
    (3) food particles are effectively smashed.
    (4) Water boils at higher temperature inside the pressure cooker.

MATHEMATICS

1. If ax + by = 1, where a, b, x and y are integers, then which one of the following is not true?
    (1) (a, b) = 1
    (2) (a, y) = 1
    (3) (x, y) = 1
    (4) (b, y) = 1

2. The digit in the unit place of the number $\lfloor 2009 + 3^{7886} \rfloor$ is
    (1) 9
    (2) 7
    (3) 3
    (4) 1

3. If $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix} = 0$, then a, b, c are
    (1) in A.P.
    (2) in G.P.
    (3) in H.P.
    (4) equal

4. The value of $\begin{vmatrix} x & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_x x & \log_z y & 1 \end{vmatrix} =$
    (1) log xyz
    (2) 0
    (3) 1
    (4) xyz

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5. If $A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 2 \end{bmatrix}$ then $|\text{adj } A| =$
   (1) 81
   (2) 0
   (3) 9
   (4) 1/9

6. If A and B are square matrices of the same order such that $(A + B)(A - B) = A^2 - B^2$, then $(ABA^{-1})^2 =$
   (1) A^2
   (2) B^2
   (3) I
   (4) A^2B^2

7. If $\vec{a} \cdot \vec{b} = -|\vec{a}|\,|\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is
   (1) 60°
   (2) 45°
   (3) 180°
   (4) 90°

8. If $\vec{a} + 2\vec{b} + 3\vec{c} = \vec{0}$, then $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} =$
   (1) $6(\vec{b} \times \vec{c})$
   (2) $2(\vec{b} \times \vec{c})$
   (3) $3(\vec{c} \times \vec{a})$
   (4) $\vec{0}$

9. If the volume of the parallelepiped with $\vec{a}, \vec{b}$ and $\vec{c}$ as conterminous edges is 40 cubic units, then the volume of the parallelepiped having $\vec{b} + \vec{c}, \vec{c} + \vec{a}$ and $\vec{a} + \vec{b}$ as conterminous edges in cubic units is
   (1) 40
   (2) 80
   (3) 120
   (4) 160

10. In the group G = {0, 1, 2, 3, 4, 5} under addition modulo 6, $(2 \oplus_6 3^{-1} \oplus_6 4)^{-1} =$
    (1) 0
    (2) 2
    (3) 3
    (4) 5

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11. Which one of the following is not true?
    (1) Identity element in a group is unique.
    (2) Inverse of an element in a group is unique.
    (3) Fourth roots of unity form an additive abelian group.
    (4) Cancellation laws hold in a group.

12. The number of subgroups of the group $(Z_5, \oplus_5)$ is
    (1) 2
    (2) 1
    (3) 3
    (4) 4

13. The negation of $p \wedge (I \rightarrow \sim r)$ is
    (1) $\sim p \vee (q \wedge r)$
    (2) $\sim p \wedge (q \wedge r)$
    (3) $p \vee (q \vee r)$
    (4) $p \vee (q \wedge r)$

14. If $n = \lfloor 2020$, then
$$\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \frac{1}{\log_4 n} + \cdots \ldots + \frac{1}{\log_{2020} n} =$$
    (1) 0
    (2) 2020
    (3) 1
    (4) $\lfloor 2020$

15. If 'n' is a positive integer, then $n^3 + 2n$ is divisible by
    (1) 3
    (2) 2
    (3) 6
    (4) 15

16. On the set of integers Z, define $f : Z \rightarrow Z$ as
$$f(n) = \begin{cases} \frac{n}{2}, & n \text{ is even} \\ 0, & n \text{ is odd} \end{cases}$$ then 'f' is
    (1) bijective
    (2) injective but not surjective
    (3) neither injective nor surrjective
    (4) surjective but not injective

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17. If α and ß are the roots of x2+x+1 = 0, then $\alpha^{16} + ß^{16}$ =
    (1) 0
    (2) 1
    (3) -1
    (4) 2

18. The total number of terms in the expansion of $(x + y)^{100} + (x - y)^{100}$ after simplification is
    (1) 50
    (2) 51
    (3) 202
    (4) 100

19. $\cot^{-1}(2.1^2) + \cot^{-1}(2.2^2) + \cot^{-1}(2.3^2) +$ ..... up to ∞ =
    (1) π/5
    (2) π/4
    (3) π/3
    (4) π/2

20. If 'x' takes negative permissible value, then $\sin^{-1} x$ us equal to
    (1) $\cos^{-1}\sqrt{1-x^2}$
    (2) $-\cos^{-1}\sqrt{1-x^2}$
    (3) $\cos^{-1}\sqrt{x^2-1}$
    (4) $\pi - \cos^{-1}\sqrt{1-x^2}$

21. If $1 + \sin x + \sin^2 x +$ ..... up to $\infty = 4 + 2\sqrt{3}, 0 < x < \pi$ and $x \neq \frac{\pi}{2}$, then $x =$
    (1) $\frac{\pi}{6}, \frac{\pi}{3}$
    (2) $\frac{\pi}{3}, \frac{5\pi}{6}$
    (3) $\frac{2\pi}{3}, \frac{\pi}{6}$
    (4) $\frac{\pi}{3}, \frac{2\pi}{3}$

22. The complex number $\frac{1+2i}{1-i}$ lies in
    (1) first quadrant
    (2) second quadrant
    (3) third quadrant
    (4) fourth quadrant

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23. If P is the point in the Argand diagram corresponding to the complex number √3+I and if OPQ is an isosceles right angled triangle, right angled at 'O', then Q represents the complex number
    (1) $-1 \pm i\sqrt{3}$
    (2) $-1 + i\sqrt{3}$ or $1 - i\sqrt{3}$
    (3) $1 \pm i\sqrt{3}$
    (4) $\sqrt{3} - i$ or $1 - i\sqrt{3}$

24. The smallest positive integral value of 'n' such that
    $\left[\frac{1 + \sin\frac{\pi}{8} + i\cos\frac{\pi}{8}}{1 + \sin\frac{\pi}{8} - i\cos\frac{\pi}{8}}\right]$ is purely imaginary is, $n =$
    (1) 8
    (2) 4
    (3) 3
    (4) 2

25. Which one of the following is possible?
    (1) $\cos\theta = \frac{7}{3}$
    (2) $\sin\theta = \frac{a^2+b^2}{a^2-b^2}, (a \neq b)$
    (3) $\sec\theta = \frac{4}{5}$
    (4) $\tan\theta = 45$

26. If one side of a triangle is double the other and the angles opposite to these sides differ by 60°, then the triangle is
    (1) right angled
    (2) obtuse angled
    (3) acute angled
    (4) isosceles

27. $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x) =$
    (1) 11
    (2) 12
    (3) 13
    (4) 14

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28. A cow is tied to a post by a rope. The cow moves along the circular path always keeping the rope tight. If it describes 44 metres, when it has traced out 72° at the centre, the length of the rope is
    (1) 35 metres
    (2) 22 metres
    (3) 56 metres
    (4) 45 metres

29. If $\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin 2\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin 2\theta \\ \sin^2\theta & \cos^2\theta & 4\sin 2\theta - 1 \end{vmatrix} = 0$ and $0 < \theta < \frac{\pi}{2}$, then $\cos 4\theta =$
    (1) $\frac{1}{2}$
    (2) $\frac{\sqrt{3}}{2}$
    (3) 0
    (4) $\frac{-1}{2}$

30. The locus of the mid points of the chords of the circle $x^2 + y^2 = 4$ which subtend a right angles at the origin is
    (1) $x + y = 2$
    (2) $x^2 + y^2 = 1$
    (3) $x^2 + y^2 = 2$
    (4) $x + y = 1$

31. The length of the chord joining the points $(4\cos\theta, 4\sin\theta)$ and $(4\cos(\theta + 60°), 4\sin(\theta + 60°))$ of the circle $x^2 + y^2 = 16$ is
    (1) 2
    (2) 4
    (3) 8
    (4) 16

32. The number of common tangents to the circles $x^2 + y^2 - y = 0$ and $x^2 + y^2 + y = 0$ is
    (1) 1
    (2) 2
    (3) 3
    (4) 0

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33. The co-ordinates of the centre of the smallest circle passing through the origin and having y = x + 1 as a diameter are
    (1) $\left(\frac{-1}{2}, \frac{1}{2}\right)$
    (2) $\left(\frac{1}{2}, \frac{-1}{2}\right)$
    (3) $\left(\frac{1}{2}, \frac{1}{3}\right)$
    (4) $(-1, 0)$

34. The length of the diameter of the circle which cuts three circles
    $x^2 + y^2 - x - y - 14 = 0$;
    $x^2 + y^2 + 3x - 5y - 10 = 0$;
    $x^2 + y^2 - 2x + 3y - 27 = 0$
    orthogonally, is
    (1) 2
    (2) 8
    (3) 6
    (4) 4

35. For the parabola $y^2 = 4x$, the point P whose focal distance is 17, is
    (1) (16, 8) or (16, -8)
    (2) (8, 8) or (8, -8)
    (3) (4, 8) or (4, -8)
    (4) (2, 8) or (2, -8)

36. The angle between the tangents drawn to the parabola $y^2 = 12x$ from the point (-3, 2) is
    (1) 45°
    (2) 90°
    (3) 60°
    (4) 30°

37. The number of values of 'e' such that the line y = 4x + c touches the curve $\frac{x^2}{4} + y^2 = 1$ is
    (1) 0
    (2) 1
    (3) 2
    (4) Infinite

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38. If the circle $x^2 + y^2 = a^2$ intersects the hyperbola $xy = c^2$ in four points $P(x_1, y_1,)$, $Q(x_2, y_2)$, $R(x_3, y_3)$ and $S(x_4, y_4)$, then
    (1) $x_1 + x_2 + x_3 + x_4 = 0$
    (2) $y_1 + y_2 + y_3 + y_4 = 2$
    (3) $x_1 x_2 x_3 x_4 = 2c^4$
    (4) $y_1 y_2 y_3 y_4 = 2c^4$

39. The foot of the perpendicular from the point (2, 4) upon x + y = 4 is
    (1) (3, -1)
    (2) (2, 2)
    (3) (4, 0)
    (4) (1, 3)

40. The vertices of a triangle are (6, 0), (0, 6) and (6, 6). The distance between its circumcentre and centroid is
    (1) 2√2
    (2) 2
    (3) √2
    (4) 1

41. The angle between the pair of lines $x^2 + 2xy - y^2 = 0$, is
    (1) π/3
    (2) π/6
    (3) π/2
    (4) 0

42. $\lim_{n \to \infty} \frac{3.2^{n+1} - 4.5^{n+1}}{5.2^n + 7.5^n} =$
    (1) 0
    (2) 3/5
    (3) -4/7
    (4) -20/7

43. The function
    $f(x) = \frac{\log(1 + ax) - \log(1 - bx)}{x}$
    is not defined at x = 0, is
    (1) 0
    (2) a – b
    (3) a + b
    (4) log a + log b

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44. If $f(x) = 1 + nx + \frac{n(n-1)}{2}x^2 + \frac{n(n-1)(n-2)}{6}x^3 + \cdots + x^n$, then $f''(1) =$
    (1) $n(n-1)^{2n}$
    (2) $n(n-1)2^{n-1}$
    (3) $(n-1)2^{n-1}$
    (4) $n(n-1)2^{n-2}$

45. If $f(x) = \log_x 2\,(\log_e x)$, then $f'(x)$ at $x = e$ is
    (1) 0
    (2) 1
    (3) 1/e
    (4) 1/2e

46. If $y = \sin^n x \cos nx$, then dy/dx is
    (1) $n \sin^{n-1} x \cos (n + 1)x$
    (2) $n \sin^{n-1} x \sin (n + 1)x$
    (3) $n \sin^{n-1} x \cos (n - 1)x$
    (4) $n \sin^{n-1} x \cos nx$

47. If $f(x) = \frac{g(x) + g(-x)}{2} + \frac{2}{[h(x)+h(-x)]^{-1}}$ where g and h are differentiable functions, then $f'(0)$
    (1) 0
    (2) 1
    (3) 1/2
    (4) 3/2

48. The tangent to a given curve y = f(x) is perpendicular to the x-axis if
    (1) dy/dx = 0
    (2) dy/dx = 1
    (3) dx/dy = 0
    (4) dx/dy = 1

49. The minimum value of $27^{\cos 2x}\ 81^{\sin 2x}$ is
    (1) 1/27
    (2) -5
    (3) 1/5
    (4) 1/243

50. A stone is thrown vertically upwards from the top of a tower 64 metres high according to the law $s = 48t - 16t^2$. The greatest height attained by the stone above the ground is
    (1) 64 metre
    (2) 36 metre
    (3) 32 metre
    (4) 100 metre

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51. The length of the subtangent at 't' on the curve x = a (t + sin t), y = a(1 - cos t) is
    (1) $2a\sin^3\left(\frac{t}{2}\right)\sec\left(\frac{t}{2}\right)$
    (2) a sin t
    (3) $2a\sin\left(\frac{t}{2}\right)\tan\left(\frac{1}{2}\right)$
    (4) $2a\sin\frac{t}{2}$

52. $\int e^{\tan^{-1}x}\left(1++\frac{x}{1+x^2}\right)dx$ is equal to
    (1) $\frac{1}{2}x\,e^{\tan^{-1}x}+c$
    (2) $xe^{\tan^{-1}x}+c$
    (3) $e^{\tan^{-1}x}x+c$
    (4) $\frac{1}{2}e^{\tan^{-1}x}+c$

53. $\int \text{cosec}\,(x-a)\,\text{cosec}\,x\,dx =$
    (1) $\frac{1}{\sin a}\log[\sin(x-a)]+C$
    (2) $\frac{-1}{\sin a}\log|\sin x\,\text{cosec}\,(x-a)|+C$
    (3) $\frac{-1}{\sin a}\log[\sin(x-a)\sin x]+C$
    (4) $\frac{1}{\sin a}\log[\sin(x-a)\text{cosec}\,x]+C$

54. If $f(x)=\int_{-1}^{x}|t|dt$, then for any $x \geq 0$, $f(x) =$
    (1) $\frac{1}{2}(1-x^2)$
    (2) $1-x^2$
    (3) $\frac{1}{2}(1+x^2)$
    (4) $1+x^2$

55. $\int_1^3 \frac{\sqrt{4-x}}{\sqrt{x}+\sqrt{4-x}}dx =$
    (1) 0
    (2) 1
    (3) 3
    (4) 2

56. The area bounded between the parabola $y^2 = 4x$ and the line y = 2x – 4 is equal to
    (1) 15 sq. units
    (2) 17/3 sq. units
    (3) 19/3 sq. units
    (4) 9 sq. units

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57. The differential equation of the family of circles passing through the origin and having their centres on the x-axis is
    (1) $x^2 = y^2 + 3xy\frac{dy}{dx}$
    (2) $y^2 = x^2 + 2xy\frac{dy}{dx}$
    (3) $y^2 = x^2 - 2xy\frac{dy}{dx}$
    (4) $x^2 = y^2 + xy\frac{dy}{dx}$

58. A population grows at the rate of 10% of the population per year. How long does it take for the population to double?
    (1) 2 log 10 years
    (2) 20 log 2 years
    (3) 10 log 2 years
    (4) 5 log 2 years

59. On the set of all natural numbers N, which one of the following * is a binary operation?
    (1) a * b = 3a – 4b
    (2) a * b = √ab
    (3) $a * b = \frac{a-b}{a+b}$
    (4) $a * b = a + 3b$

60. If $\int_0^I f(x)dx = 5$, then the value of $\ldots + 100\int_0^I x^9 f(x^{10})dx$ is equal to
    (1) 55
    (2) 125
    (3) 625
    (4) 275