Q1. Which of the following combinations has the dimension of electrical resistance (ϵ_0 is the permittivity of vacuum and μ_0 is the permeability of vacuum)?

(1) $\frac{\epsilon_0}{\mu_0}$

(2) $\sqrt{\frac{\epsilon_0}{\mu_0}}$

(3) $\frac{\mu_0}{\epsilon_0}$

(4) $\sqrt{\frac{\mu_0}{\epsilon_0}}$

Q2. The trajectory of a projectile near the surface of the earth is given as $y = 2x - 9x^2$. If it were launched at an angle θ_0 with speed v_0 then $g = 10 \text{ m s}^{-2}$:

(1) $\theta_0 = \cos^{-1}\frac{1}{\sqrt{5}}$ and $v_0 = \frac{5}{3} \text{ ms}^{-1}$

(2) $\theta_0 = \cos^{-1}\frac{2}{\sqrt{5}}$ and $v_0 = \frac{3}{5} \text{ ms}^{-1}$

(3) $\theta_0 = \sin^{-1}\frac{1}{\sqrt{5}}$ and $v_0 = \frac{5}{3} \text{ ms}^{-1}$

(4) $\theta_0 = \sin^{-1}\frac{2}{\sqrt{5}}$ and $v_0 = \frac{3}{5} \text{ ms}^{-1}$

Q3. A shell is fired from a fixed artillery gun with an initial speed u such that it hits the target on the ground at a distance R from it. If t_1 and t_2 are the values of the time taken by it to hit the target in two possible ways, the product $t_1 t_2$ is:

(1) $R/2g$

(2) R/g

(3) $2R/g$

(4) $R/4g$

Q4. A man (mass $= 50$ kg) and his son (mass $= 20$ kg) are standing on a frictionless surface facing each other. The man pushes his son so that he starts moving at a speed of 0.70 m s^{-1} with respect to the man. The speed of the man with respect to the surface is:

(1) 0.20 m s^{-1}

(2) 0.14 m s^{-1}

(3) 0.47 m s^{-1}

(4) 0.28 m s^{-1}

Q5. A person of mass M is sitting on a swing of length L and swinging with and an angular amplitude θ_0. If the person stands up when the swing passes through its lowest point, the work done by him, assuming that his centre of mass moves by a distance $ll \ll L$, is close to:

(1) $Mgl(1 - \theta_0^2)$

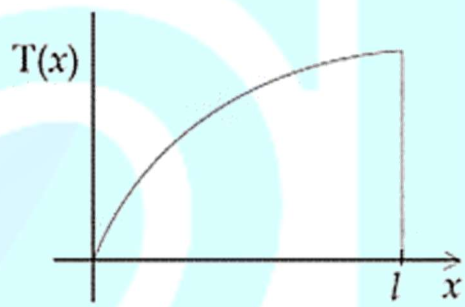
(2) $\text{Mgl}\left(1 + \frac{\theta_0^2}{2}\right)$

(3) Mgl

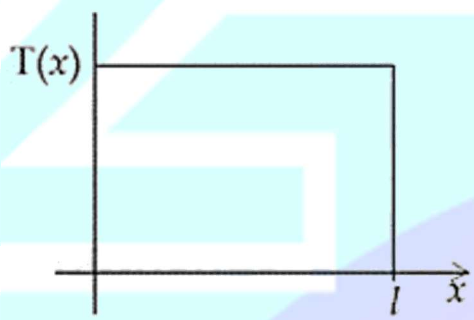
(4) $\text{Mgl}(1 + \theta_0^2)$

Q6. A uniform rod of length l is being rotated in a horizontal plane with a constant angular speed about an axis passing through one of its ends. If the tension generated in the rod due to rotation is $\text{T}(x)$ at a distance x from the axis, then which of the following graphs depicts it most closely?

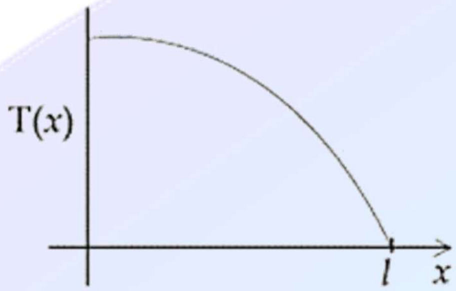
(1)



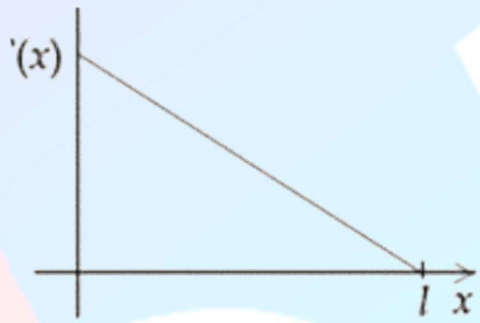
(2)



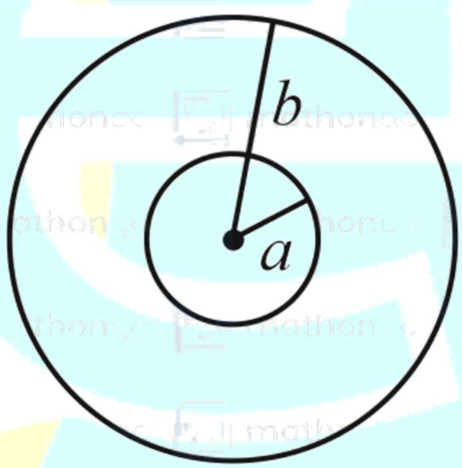
(3)



(4) T(x)



Q7. A circular disc of radius b has a hole of radius a at its centre(see figure). If the mass per unit area of the disc varies as $\frac{\sigma_0}{r}$ then, the radius of gyration of the disc about its axis passing through the center is



(1) $\frac{a+b}{3}$

(2) $\sqrt{\frac{a^2+b^2+ab}{3}}$

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

(4) $\sqrt{\frac{a^2+b^2+ab}{2}}$

Q8. At 40°C, a brass wire of 1 mm radius is hung from the ceiling. A small mass, M is hung from the free end of the wire. When the wire is cooled down from 40°C to 20°C it regains its original length of 0.2 m . The value of M is close to: (Coefficient of linear expansion and Young's modulus of brass are $10^{-5}/{}^\circ\mathrm{C}$ and $10^{11}\ \mathrm{N/m^2}$, respectively; $\mathrm{g} = 10\ \mathrm{m\ s^{-2}}$)

(1) 0.9 kg
(2) 0.5 kg
(3) 1.5 kg
(4) 9 kg

Q9. When M_1 gram of ice at -10°C (specific heat $= 0.5\mathrm{calg^{-1}\ {}^\circ C^{-1}}$) is added to M_2 gram of water at 50 °C, finally no ice is left and the water is at 0°C. The value of latent heat of ice, in cal $\mathrm{g^{-1}}$ is:

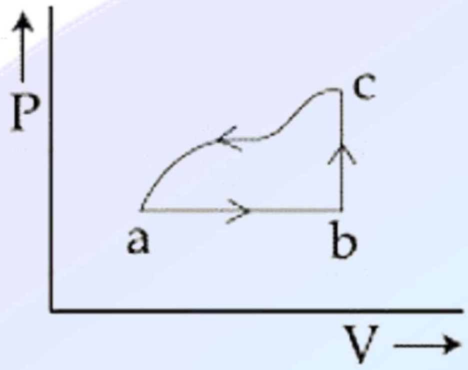
(1) $\frac{50 \quad _2}{M_1}$

(2) $\frac{5M_1}{M_2} - 50$

(3) $\frac{5M_2^1}{M_1} - 5$

(4) $\frac{50M_2}{M_1} - 5$

Q10. A sample of an ideal gas is taken through the cyclic process abca as shown in the figure. The change in the internal energy of the gas along the path ca is -180 J . The gas absorbs 250 J of heat along the path ab and 60 J along the path bc. The work done by the gas along the path abc is:

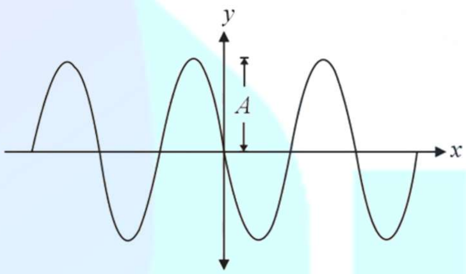


(1) 130 J
(2) 100 J
(3) 120 J
(4) 140 J

Q11. Two moles of helium gas is mixed with three moles of hydrogen molecules (taken to be rigid). What is the molar specific heat of mixture at constant volume? $R = 8.3\ \mathrm{J/molK}$
(1) $17.4\ \mathrm{J/molK}$
(2) $19.7\ \mathrm{J/molK}$
(3) $15.7\ \mathrm{J/molK}$
(4) $21.6\ \mathrm{J/molK}$

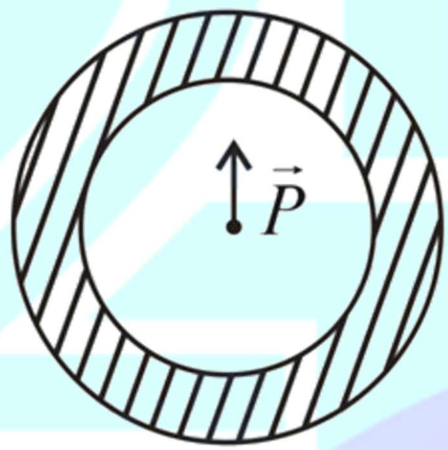
Q12. A submarine A travelling at $18\ \mathrm{kmhr^{-1}}$ is being chased along the line of its velocity by another submarine B travelling at $27\ \mathrm{kmhr^{-1}}$. B sends a sonar signal of 500 Hz to detect A and receives a reflected sound of frequency v. The value of v is closed to (Speed of sound in water $1500\ \mathrm{m\ s^{-1}}$)
(1) 504 Hz
(2) 499 Hz
(3) 502 Hz
(4) 507 Hz

Q13. A progressive wave travelling along the positive x - direction is represented by $yx, \mathrm{t} = \mathrm{A}\sin(\mathrm{k}x - \omega \mathrm{t} + \phi)$. Its snapshot at $\mathrm{t} = 0$ is given in the figure.



For this wave, the phase ϕ is:
(1) $\frac{\pi}{2}$
(2) 0
(3) π
(4) $-\frac{\pi}{2}$

Q14. Shown in the figure is a shell made of a conductor. It has inner radius a and outer radius b, and carries charge Q. At its centre a dipole $\vec{p}$ is placed as shown then:



(1) Surface charge density on the inner surface of the shell is zero everywhere.
(3) Surface charge density on the inner surface is uniform and equal to $\frac{\left(\frac{Q}{2}\right)}{4\pi a^2}$.
(2) Electric field outside the shell is the same as that of a point charge at the centre of the shell.
(4) Surface charge density on the outer surface depends on $\vec{p}$.

Q15. A Point dipole $\vec{\mathrm{p}} = -\mathrm{p}_0\hat{x}$ is kept at the origin. The potential and electric field due to this dipole on the y-axis at a distance d are, respectively: (Taken $V=0$ at infinity)

(1) $\frac{|\vec{p}|}{4\pi\varepsilon_0 d^2}, \frac{-\vec{p}}{4\pi\varepsilon_0 d^3}$

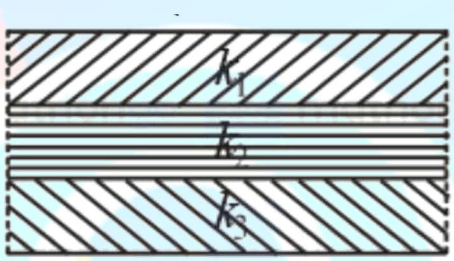
(2) $0, \frac{|\vec{p}|}{4\pi\varepsilon_0 d^3}$

(3) $\frac{|\vec{p}|}{4\pi\varepsilon_0 d^3}, \frac{\vec{p}}{4\pi\varepsilon_0 d^3}$

(4) $0, \frac{-\vec{p}}{4\pi\varepsilon_0 d^3}$

Q16. Two identical parallel plate capacitors, of capacitance C each, have plates of area A, separated by a distance d. The space between the plates of the two capacitors, is filled with three dielectrics, of equal thickness and dielectric constants K_1, K_2 and K_3. The first capaciitor is filled as shown in figure I , and the second one is filled as shown in figure II.

If these two modified capacitors are charged by the same potential V, the ratio of the energy stored in the two, would be (E_1 refers to capacitor I and E_2 to capacitor (II)):



(I)

(II)

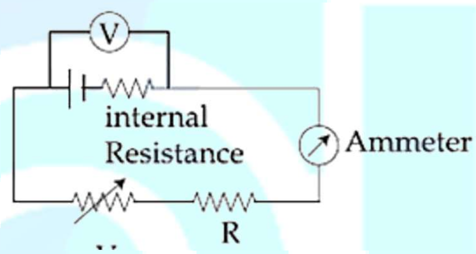
(1) $\frac{E_1}{E_2}=\frac{9K_1K_2K_3}{(K_1 K_2 K_3)(K_2 K_3+K_3 K_1 K_1+K_1 K_2)}$

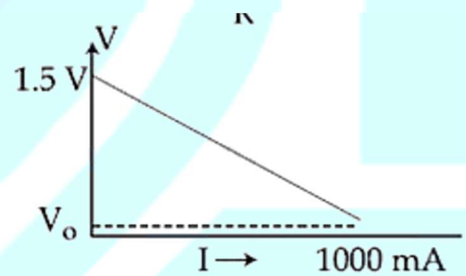
(2) $\frac{E_1}{E_2}=\frac{(K_1K_2K_3)(K_2K_3+K_3K_1K_1+K_1K_2)}{K_1K_2K_3}$

(3) $\frac{E_1}{E_2}=\frac{(K_1K_2K_3)(K_2K_3+K_3K_1K_1+K_1K_2)}{9K_1K_2K_3}$

(4) $\frac{E_1}{E_2}=\frac{K_1 K_2 K_3^3}{(K_1 K_2 K_3)(K_2 K_3+K_3 K_1 K_1+K_1 K_2)}$

Q17. To verify Ohm's law, a student connects the voltmeter across the battery as shown in the figure. The measured voltage is plotted as a function of the current, and the following graph is obtained:





If V_o is almost zero, identify the correct statement:

(1) The emf of the battery is 1.5 V and its internal resistance is 1.5Ω

(2) The value of the resistance R is 1.5Ω

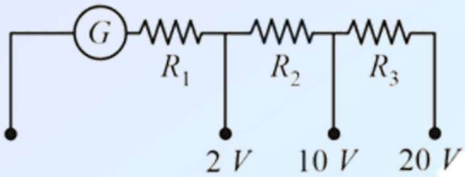
(3) The potential difference across the battery is 1.5 V when it sends a current of 1000 mA

(4) The emf of the battery is 1.5 V and the value of R is 1.5Ω

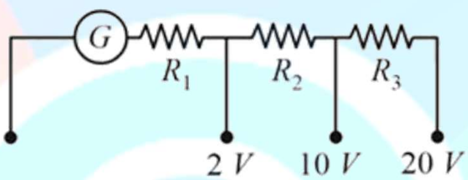
Q18. A galvanometer of resistance 100Ω has 50 divisions on its scale and has sensitivity of 20μ A/ division. It is to be converted to voltmeter with three ranges, of $0-2$ V, $0-10$ V and $0-20$ V. The appropriate circuit to do so is:

(1)

$R_1 = 19900\Omega$
$R_2 = 9900\Omega$
(2)

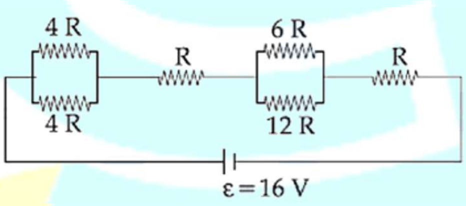


$R_1 = 1900\Omega$
$R_2 = 9900\Omega$
$R_3 = 19900\Omega$
(4)



$R_1 = 1900\Omega$
$R_2 = 8000\Omega$
$R_3 = 10000\Omega$

Q19. The resistive network shown below is connected to a D.C. source of 16 V . The power consumed by the network is 4 Watt. The value of R is:

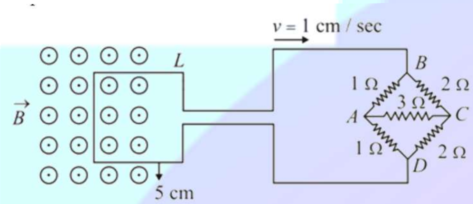


(1) 16Ω
(2) 8Ω
(3) 6Ω
(4) 1Ω

Q20. A magnetic compass needle oscillates 30 times per minute at a place where the dip is 45° and 40 times per minute where the dip is 30°. If B_1 and B_2 are the net magnetic fields due to the earth at the two places respectively, then the ratio B_1/B_2 is approximately equal to
(1) 3.6
(2) 1.8
(3) 1.2
(4) 0.7

Q21. A thin ring of 10 cm radius carries a uniformly distributed charge. The ring rotates at a constant angular speed of $40\pi \text{rads}^{-1}$ about its axis, perpendicular to its plane. Is the magnetic field its centre is 3.8×10^{-9} T, then the charge carried by the ring is close to $\mu_0 = 4\pi \times 10^{-7}\ \text{N/A}^2$.
(1) $4 \times 10^{-5}\text{C}$
(2) $3 \times 10^{-5}\text{C}$
(3) $2 \times 10^{-6}\text{C}$
(4) $7 \times 10^{-6}\text{C}$

Q22. The figure shows a square loop L of side 5 cm which is connected to a network of resistances. The whole setup is moving towards the right with a constant speed of 1 cm s^{-1}. At some instant, a part of L is in a uniform magnetic field of 1 T perpendicular to the plane of the loop. If the resistance of L is 1.7Ω, the current in the loop at that instant will be close to:



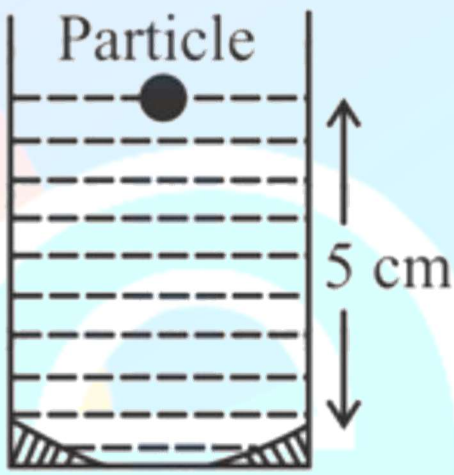
(1) 115μ A
(2) 60μ A
(3) 150μ A
(4) 170μ A

Q23. An electromagnetic wave is represented by the electric filed $\vec{E} = E_0\ \hat{A}\sin \omega t + 6y - 8z$.

Taking unit vectors in x, y and z directions to be $\hat{\imath}, \hat{\jmath}, \hat{k}$, the directions of propogations $\hat{s}$, is:

(1) $\hat{s} = \frac{3\hat{\imath}-4\hat{\jmath}}{5}$
(2) $\hat{s} = \frac{-3\hat{\imath}+4\hat{\jmath}}{5}$
(3) $\hat{S} = \frac{4\hat{\imath}-3\hat{k}}{5}$
(4) $\hat{s} = \frac{-4\hat{\imath}-3\hat{k}}{5}$

Q24. A concave mirror has radius of curvature of 40 cm . It is at the bottom of a glass that has water filled up to 5 cm (see figure). If a small particle is floating on the surface of water, its image as seen, from directly above the glass, is at a distance d from the surface of water. The value of d is close to: (Refractive index of water = 1.33)



(1) 13.4 cm
(2) 8.8 cm
(3) 6.7 cm
(4) 11.7 cm

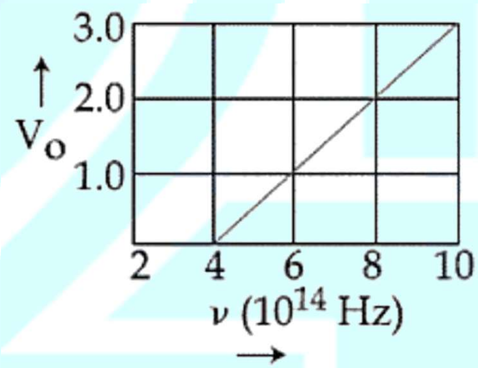
Q25.The value of numerical aperture of the objective lens of a microscope is 1.25 . If light of wavelength 5000Å is used, the minimum separation between two points, to be seen as distinct, will be:

(1) 0.48μ m
(2) 0.24μ m
(3) 0.38μ m
(4) 0.12μ m

Q26. In a double slit experiment, when a thin film of thickness t having refractive index μ is introuduced in front of one of the slits, the maximum at the centre of the fringe pattern shifts by one fringe width. The value of t is (λ is the wavelength of the light used):

(1) $\frac{\lambda}{2(\mu-1)}$
(2) $\frac{\lambda}{(2\mu-1)}$
(3) $\frac{2\lambda}{(\mu-1)}$
(4) $\frac{\lambda}{(\mu-1)}$

Q27. The stopping potential V_o (in volt) as a function of frequency (ν) for a sodium emitter, is shown in the figure. The work function of sodium, form the data plotted in the figure, will be:
(Given: Planck's constant $h = 6.63 \times 10^{-34}$ J s, electron charge (e) $= 1.6 \times 10^{-19}$C)

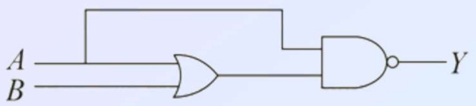


(1) 2.12 eV
(2) 1.82 eV
(3) 1.95 eV
(4) 1.66 eV

Q28. An excited He^{+}ion emits two photons in succession, with wavelengths 108.5 nm and 30.4 nm in making a transition to the ground state. The quantum number n , corresponding to its initial excited state is (for a photon of wavelength λ, energy $E = \frac{1240 \mathrm{eV}}{\lambda(\text{ in nm })}$)

(1) $n = 6$
(2) $n = 5$
(3) $n = 7$
(4) $n = 4$

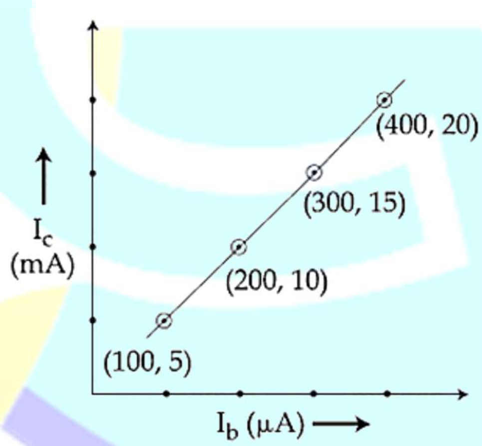
Q29. The truth table for the circuit given in the figure is:



(1) A B Y
(2) A B Y
000
0 01
010
010
101
100
111
110
(3) A B Y
0 0 1
011
101
111

	A	B	Y
	0	0	1
(4)	0	1	1
	1	0	0
	1	1	0

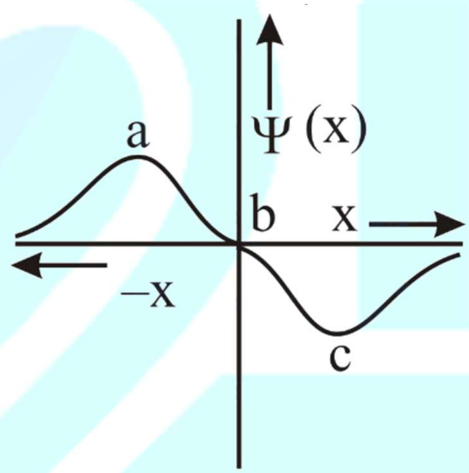
Q30. The transfer characteristic curve of a transistor, having input and output resistance 100Ω and $100k\Omega$ respectively, is shown in the figure. The voltage and power gain, are respectively:



(1) $5 \times 10^4, 2.5 \times 10^6$
(2) $2.5 \times 10^4, 2.5 \times 10^6$
(3) $5 \times 10^4, 5 \times 10^6$
(4) $5 \times 10^4, 5 \times 10^5$

Q31. 5 moles of AB_2 weigh 125×10^{-3} kg and 10 moles of A_2 B_2 weigh 300×10^{-3} kg. The molar mass of A (M_A) in $kgmol^{-1}$ are:
(1) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$
(2) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$
(3) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$
(4) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$

Q32. The electrons are more likely to be found:



(1) Only in the region a
(2) In the region a and b
(3) In the region a and c
(4) Only in the region c

Q33. The group number, number of valence electrons, and valency of an element with atomic number 15, respectively, are:
(1) 15,6 and 2
(2) 16,6 and 3
(3) 16,5 and 2
(4) 15,5 and 3

Q34. The correct statement among the following is:
(1) SiH_{33} N is planar and less basic than CH_3 N
(2) SiH_{3_3} N is pyramidal and more basic than CH_3 N

(3) SiH_{33} N is pyramidal and less basic than CH_{33} N
(4) SiH_{33} N is planar and more basic than CH_{33} N

Q35. An ideal gas is allowed to expand from 1 L to 10 L against a constant external pressure of 1 bar. The work done in kJ is:
(1) +10.0
(2) -2.0
(3) -0.9
(4) -9.0

Q36. Enthalpy of sublimation of iodine is $24 cal g^{-1}$ at $200°C$. If specific heat of I_2 (s) and I_2 (vap) are 0.055 and $0.031 cal g^{-1} K^{-1}$ respectively, then enthalpy of sublimation of iodine at $250°C$ in $cal g^{-1}$ is:
(1) 11.4
(2) 2.85
(3) 22.8
(4) 5.7

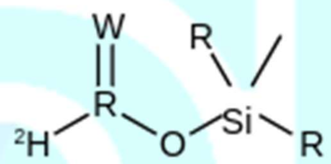
Q37. What is the molar solubility of $AlOH_3$ in 0.2 M NaOH solution? Given that, solubility product of $AlOH_3 = 2.4 \times 10^{-24}$:
(1) 3×10^{-1}
(2) 12×10^{-21}
(3) 12×10^{-23}
(4) 3×10^{-22}

Q38. An example of a disproportionation reaction is
(1) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$
(2) $2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$
(3) $2CuBr \rightarrow CuBr_2 + Cu$
(4) $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$

Q39. Given:
$Co^{3+} + e^- \rightarrow Co^{2+}; E° = +1.81$ V
$Pb^{3+} + 2e^- \rightarrow Pb^{2+}; E° = +1.67$ V
$Ce^{4+} + e^- \rightarrow Ce^{3+}; E° = +1.61$ V
$Bi^{3+} + 3e^- \rightarrow Bi; E° = +0.20$ V
Oxidizing power of the species will increase in the order:
(1) $Co^3+ < Ce^{4+} < Bi^{3+} < Pb^{4+}$
(2) $Bi^3+ < Ce^{4+} < Pb^{4+} < Co^{3+}$
(3) $Co^3+ < Pb^{4+} < Ce^{3+} < Bi^{4+}$
(4) $Ce^4+ < Pb^{4+} < Bi^{3+} < Co^{3+}$

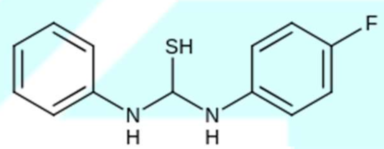
Q40. The correct sequence of thermal stability of the following carbonates is:
(1) $BaCO_3 < CaCO_3 < SrCO_3 < MgCO_3$
(2) $MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$
(3) $BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$
(4) $MgCO_3 < SrCO_3 < CaCO_3 < BaCO_3$

Q41. The basic structural unit of feldspar, zeolites mica, and asbestos is:
(1) $SiO_4{}^{4-}$
(2)

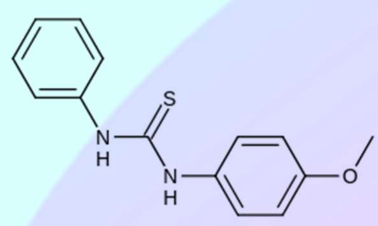


(3) $SiO_3{}^{2-}$
(4) SiO_2

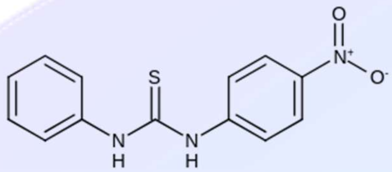
Q42. The increasing order of the pK_b of the following compund is:



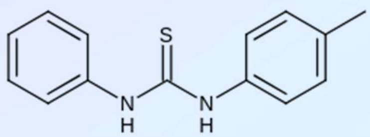
(A)



(B)

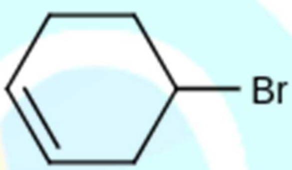


(C)



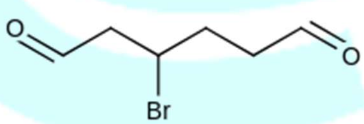
(1) (B) < (D) < (C) < (A)
(2) (B) < (D) < (A) < (C)
(3) (C) < (A) < (D) < (B)
(4) (A) < (C) < (D) < (B)

Q43. The major product (s) obtained in the following reaction is/are:



(i) $tO^{-}BuK$
$\rightarrow$
(ii) O_3/Me_2 S

(1)



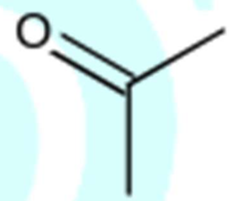
(2) OHC
CHO
(3)

(4) OHC ~ CHO

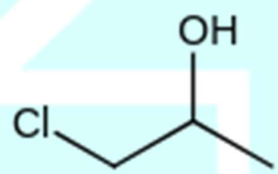
Q44. The major product of the following addition reaction is

$$H_3C-CH=CH_2 \xrightarrow{Cl_2/H_2O}$$

(1)

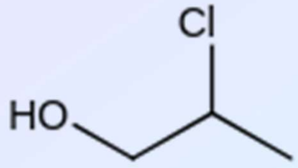


(2)

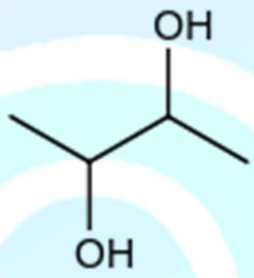


(3)

(4)



Q45. But-2-ene on reaction with alkaline $KMnO_4$ at elevated temperature followed by acidification will give:
(1)
2 molecules of
CH_3COOH
(2)



(3)
2 Molecules of CH_3CHO
(4)
One molecular of CH_3CHO and one molecular of CH_3COOH

Q46. The correct set of species responsible for the photochemical smog is:
(1) CO_2, NO_2, SO_2 and hydrocarbons
(2) NO_2, O_2, O_3 and hydrocarbons
(3) NO_2, NO_2 and hydrocarbons
(4) NO, NO_2, O_3 and hydrocarbons

Q47. An element has a face-centered cubic fcc structure with a cell edge of a. The distance between the centres of two nearest tetrahedral voids in the lattice is
(1) $\frac{a}{2}$
(2) $\frac{3}{2}$ a
(3) a
(4) $\sqrt{2a}$

Q48. The mole fraction of a solvent in aqueous solution of a solute is 0.8 . The molality (in $molkg^{-1}$) of the aqueous solution is:
(1) 13.88×10^{-3}
(2) 13.88×10^{-1}
(3) 13.88
(4) 13.88×10^{-2}

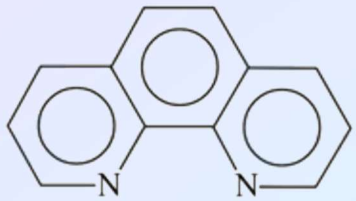
Q49. In the following reaction; $xA \rightarrow yB$
$$\log_{10} - \frac{dA}{dt} = \log_{10} - \frac{dB}{dt} + 0.3010$$
' A ' and ' B ' respectively can be:
(1) C_2H_4 and C_4H_8
(2) C_2H_2 and C_6H_6
(3) n-Butane and Iso-butane
(4) N_2O_4 and NO_2

Q50. Peptization is a:
(1) Process of converting a colloidal solution into precipitate
(3) Process of bringing colloidal molecule into solution
(2) Process of converting soluble particles to form colloidal solution
(4) Process of converting precipitate into colloidal solution

Q51. The idea of froth flotation method came from a person X and this method is related to the process Y of ores. X and Y , respectivity, are:
(1) Washer man and reduction
(2) Fisher women and concentration
(3) Fisher man and reduction
(4) Washer woman and concentration

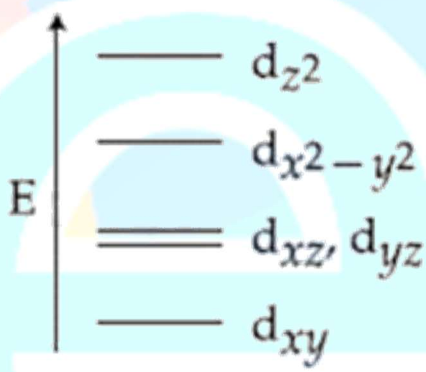
Q52. The metal that gives hydrogen gas upon treatment with both the acid as well as the base is
(1) Zinc
(2) Magnesium
(3) Iron
(4) Mercury

Q53. The complex ion that will lose its crystal field stabilization energy upon oxidation of metal to +3 state is:

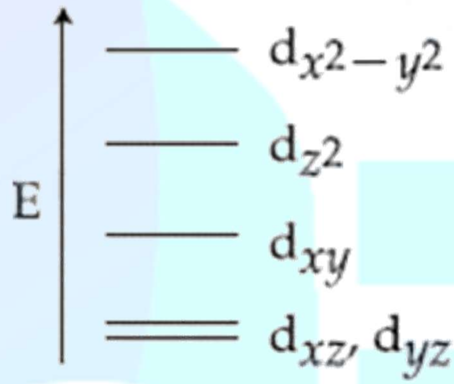
(Phen = 

and
ignore pairing energy)
(1) $Niphen_3^{2+}$
(2) $Fephen_3^{2+}$
(3) $Cophen_3^{2+}$
(4) $Znphen_3^{2+}$

Q54. Complete removal of both the axial ligands (along the z - axis) from an octahedral complex leads to which of the following splitting patterns? (relative orbital energies not on scale).
(1)



(2)

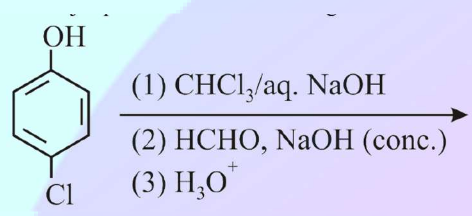


(3)

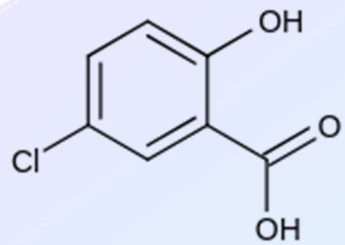
(4)

E
$= -d_{x^2-y^2}$
$= d_{xy}$
$=$
d_{z^2}
d_{xz}
d_{yz}

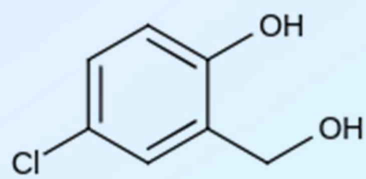
Q55. The major products of the following reaction are:



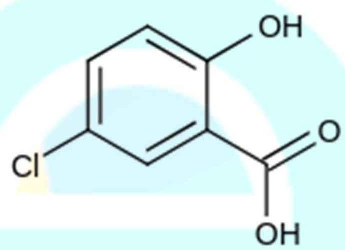
(1)



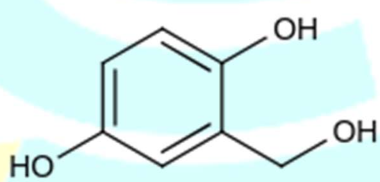
and Methanol
(2)



(3)

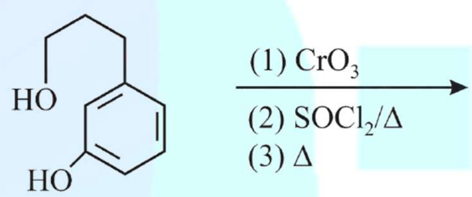


and Methanol
(4)

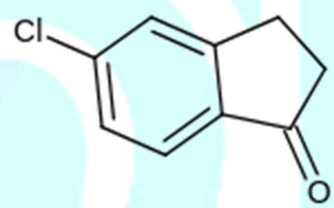


and Formic acid

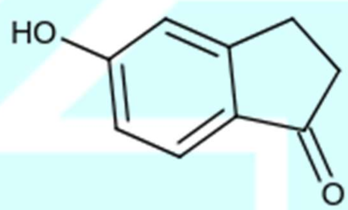
Q56. The major product of the following reaction



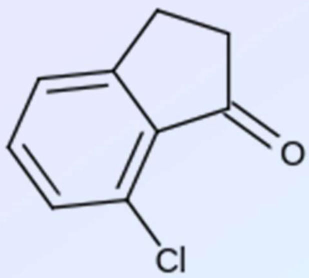
(1)



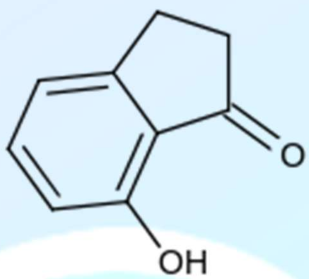
(2)



(3)



(4)



Q57. Which of the following is a thermosetting polymer?
(1) Bakelite
(2) PVC
(3) Nylon 6
(4) Buna-N

Q58. An organic compound ' A ' is oxidized with $\mathrm{Na_2O_2}$ followed by boiling with $\mathrm{HNO_3}$. The resultant solution is then treated with ammonium molybdate to yield a yellow percipitate. Based on a above observation, the element present in the given compound is:
(1) Fluorine
(2) Phosphorus
(3) Nitrogen
(4) Sulphur

Q59. Glucose and Galactose are having identical configuration in all the positions except position.
(1) C-3
(2) C-4
(3) $\mathrm{C}-5$
(4) C-2

Q60. Which of the following statements is not true about RNA?
(1) It controls the synthesis of protein
(2) It usually does not replicate
(3) It has always double standard α - helix structure
(4) It is present in the nucleus of the cell

Q61. If α and β are the roots of the equation $375x^2 - 25x - 2 = 0$, then $\lim\limits_{n\to\infty} \sum_{r=1}^{n} \alpha^r + \lim\limits_{n\to\infty} \sum_{r=1}^{n} \beta^r$ is equal to:
(1) $\frac{1}{12}$
(2) $\frac{21}{346}$
(3) $\frac{7}{116}$
(4) $\frac{29}{358}$

Q62. The equation $|z - i| = |z - 1|, i = \sqrt{-1}$, represents:
(1) a circle of radius $\frac{1}{2}$
(2) a circle of radius 1
(3) the line through the origin with slope 1
(4) the line through the origin with slope -1

Q63. The Number of ways of choosing 10 objects out of 31 objects of which 10 are identical and the remaining 21 are distinct, is:
(1) 2^{20}
(2) 2^{21}
(3) $2^{20} + 1$
(4) $2^{20} - 1$

Q64. If three of the six vertices of a regular hexagon are chosen at random, then the probability that the triangle formed with these chosen vertices is equilateral is:
(1) $\frac{1}{10}$
(2) $\frac{3}{10}$
(3) $\frac{1}{5}$
(4) $\frac{3}{20}$

Q65. Let S_n denote the sum of the first n terms of an $A.P$. If $S_4 = 16$ and $S_6 = -48$, then S_{10} is equal to:
(1) -320
(2) -380
(3) -260
(4) -410

Q66. The coefficient of x^{18} in the product $1+x1-x^{10}1+x+x^{2\ 9}$ is
(1) 84
(2) -84
(3) -126
(4) 126

Q67. The equation $y=\sin x \sin x+2-\sin^2(x+1)$ represents a straight line lying in:
(1) first, third and fourth quadrants
(2) second and third quadrants only
(3) first, second and fourth quadrants
(4) third and fourth quadrants only

Q68. The number of solutions of the equation $1+\sin^4 x=\cos^2 3x, x\in-\frac{5\pi}{2},\frac{5\pi}{2}$ is:
(1) 5
(2) 7
(3) 3
(4) 4

Q69. If the angle of intersection at a point where the two circles with radii 5 cm and 12 cm intersect is 90°, then the length (in cm) of their common chord is:
(1) $\frac{120}{13}$
(2) $\frac{60}{13}$
(3) $\frac{13}{5}$
(4) $\frac{13}{2}$

Q70. If the normal to the ellipse $3x^2+4y^2=12$ at a point P on it is parallel to the line, $2x+y=4$ and the tangent to the ellipse at P passes through $Q(4,4)$ then PQ is equal to:
(1) $\frac{\sqrt{61}}{2}$
(2) $\frac{5\sqrt{5}}{2}$
(3) $\frac{\sqrt{157}}{2}$
(4) $\frac{\sqrt{221}}{2}$

Q71. Let P be the point of intersection of the common tangents to the parabola $y^2=12x$ and the hyperbola $8x^2-y^2=8$. If S and S' denote the foci of the hyperbola where S lies on the positive x-axis then P divides SS' in a ratio:
(1) $5:4$
(2) $2:1$
(3) $13:11$
(4) $14:13$

Q72. If the truth value of the statement $p\rightarrow\sim q\vee r$ is false F, then the truth values of the statements p,q,r are respectively
(1) T,F,T
(2) T,F,F
(3) T,T,F
(4) F,T,T

Q73. If the data $x_1,x_2,\ldots x_{10}$ is such that the mean of first four of these is 11 , the mean of the remaining six is 16 and the sum of squares of all of these is 2000 , then the standard deviation of this data is:
(1) $2\sqrt{2}$
(2) 4
(3) 2
(4) $\sqrt{2}$

Q74. If $B=\begin{matrix}5 & 2 & 1\\ 0 & 2 & 1\end{matrix}$ is the inverse of a 3×3 matix A, then the sum of all values of α for which $\det A+1=0$, is:
(1) 2
(2) 1
(3) 0
(4) -1

Q75. If A is a symmetric matrix and B is skew-symmetric matrix such that $A+B=\begin{matrix}2 & 3\\ 5 & -1\end{matrix}$, then AB is equal to:
(1) $\begin{matrix}-4 & 2\\ 1 & 4\end{matrix}$
(2) $\begin{matrix}4 & -2\\ 1 & -4\end{matrix}$
(3) $4\ -2$
(4) $\begin{matrix}-4 & -2\\ -1 & 4\end{matrix}$

Q76. The value of $\sin^{-1}\frac{12}{13}-\sin^{-1}\frac{3}{5}$ is equal to:
(1) $\pi-\cos^{-1}\frac{33}{65}$
(2) $\frac{\pi}{2}-\cos^{-1}\frac{9}{65}$
(3) $\pi-\sin^{-1}\frac{63}{65}$
(4) $\frac{\pi}{2}-\sin^{-1}\frac{56}{65}$

Q77. For $x\in R$, Let $[x]$ denotes the greatest integer $\le x$, then the sum of the series $-\frac{1}{3}+$

$-\frac{1}{3}-\frac{1}{100}+-\frac{1}{3}-\frac{2}{100}+\cdots\ldots+-\frac{1}{3}-\frac{99}{100}$ is

(1) -131

(2) -153

(3) -135

(4) -133

Q78. For $x\in\left(0,\frac{3}{2}\right)$, let $fx=\sqrt{x}, gx=\tan x$ and $hx=\frac{1-x^2}{1+x^2}$. If $\phi x=(\text{hof})\text{og})(x)$, then $\phi\frac{\pi}{3}$ is equal to:

(1) $\tan\frac{\pi}{12}$

(2) $\tan\frac{5\pi}{12}\pi$

(3) $\tan\frac{7\pi}{12}$

(4) $\tan\frac{12\pi}{12}$

Q79. If $e^y+xy=e$, the ordered pair $\frac{dy}{dx},\frac{d^2y}{dx^2}$ at $x=0$ is equal to

(1) $-\frac{1}{e},-\frac{1}{e^2}$

(2) $-\frac{1}{e},\frac{1}{e^2}$

(3) $\frac{e^e}{e^e},-\frac{1}{e^2}$

(4) $\frac{1}{e'},\frac{1}{e^2}$

Q80. A 2 m ladder leans against a vertical wall. If the top of the ladder begins to slide down the wall at the rate 25 cm/sec, then the rate (in cm/sec.) at which the bottom of the ladder slides away from the wall on the horizontal ground when the top of the ladder is 1 m above the ground is:

(1) 25

(2) $25\sqrt{3}$

(3) $\frac{25}{3}$

(4) $\frac{25}{\sqrt{3}}$

Q81. If m is the minimum value of k for which the function $fx=x\sqrt{kx-x^2}$ is increasing in the interval [0, 3] and M is the maximum value of f in [0,3] when $k=m$, then the ordered pair (m,M) is equal to:

(1) $4,3\sqrt{3}$

(2) $5,3\sqrt{6}$

(3) $3,3\sqrt{3}$

(4) $4,3\sqrt{2}$

Q82. The integral $\int\frac{2x^3-1}{x^4+x}dx$, is equal to

(1) $\frac{1}{2}\log_e\frac{(x^3+1)^2}{|x^3|}+C$

(2) $\log_e\frac{|x^3+1|}{x^2}+C$

(3) $\log_e\frac{x^3+1}{x}+C$

(4) $\frac{1}{2}\log_e\frac{|x^3+1|}{x^2}+C$

Q83. Let $f:R\to R$ be a continuous and differentiable function such that $f2=6$ and $f'2=\frac{1}{48}$. If $\int_6^{f(x)}4t^3dt=x-2gx$, then $\lim_{x\to2}gx$ is equal to

(1) 24

(2) 18

(3) 12

(4) 36

Q84. If $\int_0^{\frac{\pi}{2}}\frac{\cot x}{\cot x+\text{cosec}x}dx=m(\pi+n)$, then mn is equal to

(1) 1

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

(3) -1

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

Q85. If the area (in sq. units) of the region $x,y:y^2\le4x, x+y\le1, x\ge0, y\ge0$ is $a\sqrt{2}+b$, then $a-b$ is equal to

(1) 6

(2) $\frac{10}{3}$

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

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

Q86. Consider the differential equation, $y^2dx+x-\frac{1}{y}dy=0$. If value of y is 1 when $x=1$, then the value of x for which $y=2$, is

(1) $\frac{3}{2}-\frac{1}{\sqrt{\ }e}$

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

(3) $\frac{1}{2}+\frac{1}{\sqrt{e}}$

(4) $\frac{5}{2}+\frac{1}{\sqrt{e}}$

Q87. If the volume of parallelepiped formed by the vectors $\hat{\imath}+\lambda\hat{\jmath}+\hat{k}, \hat{\jmath}+\lambda\hat{k}$ and $\lambda\hat{\imath}+\hat{k}$ is minimum, then λ is equal to:

(1) $-\frac{1}{\sqrt{3}}$

(2) $-\sqrt{3}$
(3) $\sqrt{3}$
(4) $\frac{1}{\sqrt{3}}$

Q88. Let $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$ be two vectors. If a vector perpendicular to both the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ has the magnitude 12 then one such vector is:
(1) $4(2\hat{\imath} + 2\hat{\jmath} + \hat{k})$
(2) $4(2\hat{\imath} - 2\hat{\jmath} - \hat{k})$
(3) $4(-2\hat{\imath} - 2\hat{\jmath} + \hat{k})$
(4) $4(2\hat{\imath} + 2\hat{\jmath} - \hat{k})$

Q89. If the line $\frac{x-2}{3} = \frac{y+1}{2} = \frac{z-1}{-1}$ intersects the plane $2x + 3y - z + 13 = 0$ at a point P and the plane $3x + y + 4z = 16$ at a point Q, then PQ is equal to
(1) $2\sqrt{7}$
(2) 14
(3) $2\sqrt{14}$
(4) $\sqrt{14}$

Q90. Let a random variable X has a binomial distribution with mean 8 and variance 4. If $PX \leq 2 = \frac{k}{2^{16}}$, then the value of k is equal to
(1) 121
(2) 1
(3) 17
(4) 137

ANSWER KEYS

1. (4)	2. (1)	3. (3)	4. (1)	5. (4)	6. (3)	ma. (2)	8. (4)
9. (4)	10. (1)	11. (1)	12. (3)	13. (3)	14. (2)	15. (4)	16. (1)
17. (1)	18. (4)	19. (2)	20. (4)	21. (2)	22. (4)	23. (2)	24. (2)
25. (2)	26. (4)	27. (4)	28. (2)	29. (4)	30. (1)	31. (1)	32. (3)
33. (4)	34. (1)	35. (3)	36. (3)	37. (4)	38. (3)	39. (2)	40. (2)
41. (1)	42. (2)	43. (3)	44. (2)	45. (1)	46. (4)	47. (1)	48. (3)
49. (1)	50. (4)	51. (4)	52. (1)	53. (2)	54. (4)	55. (2)	56. (2)
57. (1)	58. (2)	59. (2)	60. (3)	61. (1)	62. (3)	63. (1)	64. (1)
65. (1)	66. (1)	67. (4)	68. (1)	69. (1)	70. (2)	71. (1)	72. (3)
73. (3)	74. (2)	75. (3)	76. (4)	77. (4)	78. (4)	79. (2)	80. (4)
81. (1)	82. (3)	83. (2)	84. (3)	85. (1)	86. (1)	87. (4)	88. (2)
89. (3)	90. (4)						