Q1. The diameter and height of a cylinder are measured by a meter scale to be $12.6 \pm 0.1\,cm$ and $34.2 \pm 0.1\,cm$, respectively. What will be the value of its volume in appropriate significant figures?

(1) $4264 \pm 81 cm^3$ (2) $4264.4 \pm 81.0\ cm^3$

(3) $4260 \pm 80\ cm^3$ (4) $4300 \pm 80\ cm^3$

Q2. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. The magnitude of $\left(\vec{A}+\vec{B}\right)$ is ' n ' times the magnitude of $\left(\vec{A}-\vec{B}\right)$. The angle between $\vec{A}$ and $\vec{B}$ is:

(1) $\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$ (2) $\sin^{-1}\left[\frac{n-1}{n+1}\right]$

(3) $\cos^{-1}\left[\frac{n-1}{n+1}\right]$ (4) $\sin^{-1}\left[\frac{n^2-1}{n^2+1}\right]$

Q3. Two forces P and Q, of magnitude $2F$ and $3F$, respectively, are at an angle θ with each other. If the force Q is doubled, then their resultant also gets doubled. Then, the angle θ is:

(1) 120° (2) 60°

(3) 30° (4) 90°

Q4. A particle starts from the origin at time $t = 0$ and moves along the positive x-axis. The graph of velocity with respect to time is shown in figure. What is the position of the particle at time $t = 5s$?

(1) $10\ m$ (2) $9\ m$

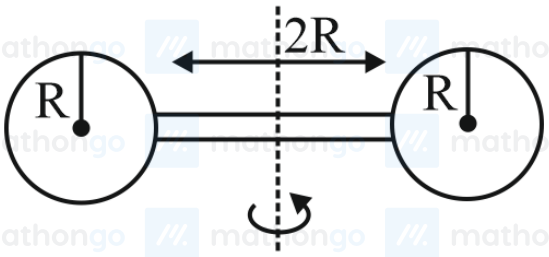
(3) $6m$ (4) $3m$

Q5. A particle which is experiencing a force, given by $\vec{F} = 3\hat{i} - 12\hat{j}$, undergoes a displacement of $\vec{d} = 4\hat{i}$. If the particle had a kinetic energy of 3 J at the beginning of the displacement, what is its kinetic energy at the end of the displacement?

(1) 9 J. (2) 15 J.

(3) 12 J. (4) 10 J.

Q6. Two identical spherical balls of mass M and radius R each are stuck on two ends of a rod of length $2R$ and mass M(see figure). The moment of inertia of the system about the axis passing perpendicularly through the centre of the rod is



(1) $\frac{209}{15}MR^2$.
(2) $\frac{152}{15}MR^2$.
(3) $\frac{137}{15}MR^2$.
(4) $\frac{17}{5}MR^2$.

Q7. A rigid massless rod of length $3l$ has two masses attached at each end as shown in the figure. The rod is pivoted at point P on the horizontal axis. When released from the initial horizontal position, its instantaneous angular acceleration will be

(1) $\frac{g}{2l}$
(2) $\frac{7g}{3l}$
(3) $\frac{g}{3l}$
(4) $\frac{g}{13l}$

Q8. Two stars of masses 3×10^{31} kg each, and at distance 2×10^{11} m rotate in a plane about their common centre of mass O. A meteorite passes through O moving perpendicular to the stars,s rotation plane. In order to escape from the gravitational field of this double star, the minimum speed that meteorite should have at O is (Take Gravitational constant $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2})

(1) 2.4×10^4 m s^{-1}
(2) 3.8×10^4 m s^{-1}
(3) 2.8×10^5 m s^{-1}
(4) 1.4×10^5 m s^{-1}

Q9. Half mole of an ideal monoatomic gas is heated at a constant pressure of 1 atm from 20° C to 90° C. Work done by the gas is(Gas constant,$R = 8.21$ J mol^{-1} K^{-1})

(1) 73 J
(2) 581 J
(3) 291 J
(4) 146 J

Q10. An unknown metal of mass 192 g heated to a temperature of 100°C was immersed into a brass calorimeter of mass 128 g containing 240 g of water at a temperature of 8.4°C. Calculate the specific heat of the unknown metal if water temperature stabilizes at 21.5°C. (Specific heat of brass is 394$J\,kg^{-1}K^{-1}$)

(1) 916 $J\,kg^{-1}K^{-1}$
(2) 458 $J\,kg^{-1}K^{-1}$
(3) 654 $J\,kg^{-1}K^{-1}$
(4) 1232 $J\,kg^{-1}K^{-1}$

Q11. 2 kg of a monoatomic gas is at a pressure of 4×10^4 N m^{-2}. The density of the gas is 8 kg m^{-3}. What is the order of energy of the gas due to its thermal motion?

(1) 10^5 J
(2) 10^6 J
(3) 10^4 J
(4) 10^3 J

Q12. A hoop and a solid cylinder of same mass and radius are made of a permanent magnetic material with their respective axes. But the magnetic moment of hoop is twice of solid cylinder. They are placed in a uniform magnetic field in such a manner that their magnetic moments make a small angle with the field. If the oscillation periods of hoop and cylinder are T_h and T_c respectively, then:

(1) $T_h = 2T_c$ (2) $T_h = T_c$

(3) $T_h = 0.5T_c$ (4) $T_h = 1.5T_c$

Q13. A particle executes simple harmonic motion with an amplitude of 5 cm . When the particle is at 4 cm from the mean position, the magnitude of its velocity in SI units is equal to that of its acceleration. Then, its periodic time in seconds is:

(1) $\frac{8\pi}{3}$ (2) $\frac{3}{8}\pi$

(3) $\frac{4\pi}{3}$ (4) $\frac{7}{3}\pi$

Q14. A cylindrical plastic bottle of negligible mass is filled with 310 ml of water and left floating in a pond with still water. If pressed downward slightly and released, it starts performing simple harmonic motion at angular frequency ω. If the radius of the bottle is 2.5 cm then ω is close to: (density of water $= 10^3 kg/m^3$)

(1) 5.00 rad sec^{-1} (2) 2.50 rad sec^{-1}

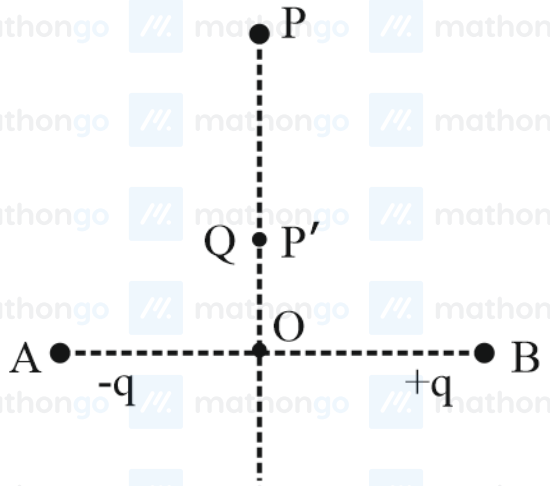
(3) 7.9 rad sec^{-1} (4) 3.75 rad sec^{-1}

Q15. A closed organ pipe has a fundamental frequency of 1.5 kHz. The number of overtones that can be distinctly heard by a person with this organ pipe will be (Assume that the highest frequency a person can hear is 20,000 Hz).

(1) 7 (2) 4

(3) 6 (4) 5

Q16. Charges $-q$ and $+q$, located at A and B, respectively, constitute an electric dipole. Distance $AB = 2a$, O is the mid point of the dipole and OP is perpendicular to AB. A charge Q is placed at P where $OP = y$ and $y \gg 2a$. The charge Q experiences an electrostatic force F. If Q is now moved along the equatorial line to $P\prime$ such that $OP\prime = \left(\frac{y}{3}\right)$ the force on Q will be close to $\left(\frac{y}{3} \ll 2a\right)$



(1) $27F$. (2) $\frac{F}{3}$.

(3) $3F$. (4) $9F$.

Q17. Four equal point charges Q each are placed in the xy plane at $(0, 2), (4, 2), (4, -2)$ and $(0, -2)$. The work required to put a fifth charge Q at the origin of the coordinate system will be:

(1) $\frac{Q^2}{4\pi\epsilon_0}$ (2) $\frac{Q^2}{2\sqrt{2}\pi\epsilon_0}$

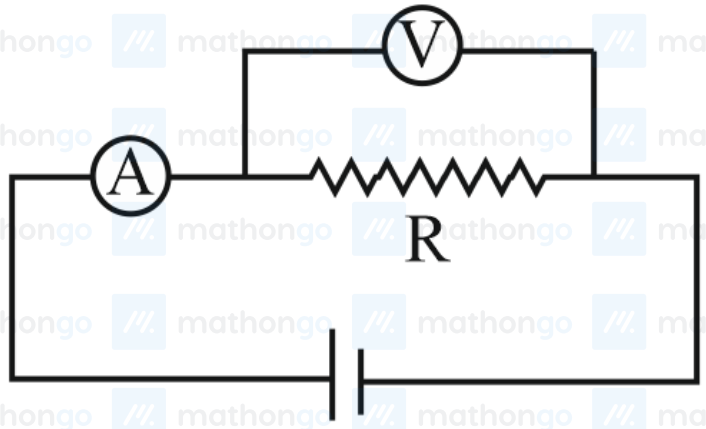
(3) $\frac{Q^2}{4\pi\epsilon_0}\left(1+\frac{1}{\sqrt{5}}\right)$ (4) $\frac{Q^2}{4\pi\epsilon_0}\left(1+\frac{1}{\sqrt{3}}\right)$

Q18. A parallel plate capacitor having capacitance 12 pF is charged by a battery to a potential difference of 10 V between its plates. The charging battery is now disconnected and a porcelain slab of dielectric constant 6.5 is slipped between the plates. The work done by the capacitor on the slab is

(1) 560 pJ (2) 600 pJ

(3) 508 pJ (4) 692 pJ

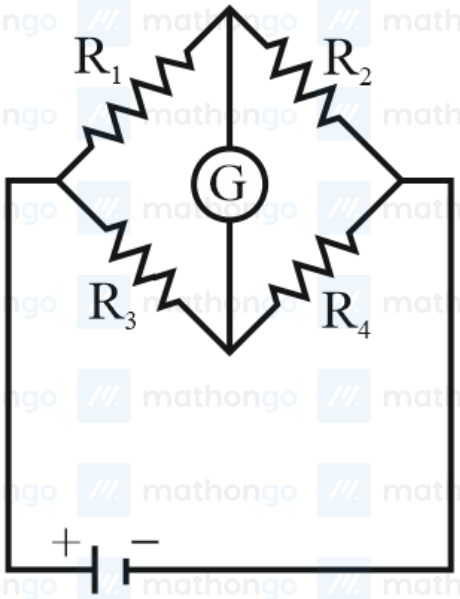
Q19. The actual value of resistance R, shown in the figure is 30Ω. This is measured in an experiment as shown using the standard formula $R = \frac{V}{I}$, where V and I are the readings of the voltmeter and ammeter, respectively. If the measured value of R is 5% less, then the internal resistance of the voltmeter is:



(1) 35Ω (2) 600Ω

(3) 570Ω (4) 350Ω

Q20. The Wheatstone bridge shown in the figure below, gets balanced when the carbon resistor used as R_1 has the colour code (orange, red, brown). The resistors R_2 and R_4 are 80 Ω and 40 Ω, respectively. Assuming that the colour code for the carbon resistors gives their accurate values, the colour code for the carbon resistor, used as R_3, would be



(1) brown, blue, black.
(2) brown, blue, brown.
(3) grey, black, brown.
(4) red, green, brown.

Q21. A current of 2 mA was passed through an unknown resistor which dissipated a power of 4.4 W. Dissipated power when an ideal power supply of 11 V is connected across it is:
(1) 11×10^{5} W
(2) 11×10^{-3} W
(3) 11×10^{-5} W
(4) 11×10^{-4} W

Q22. At some location the horizontal component of earth's magnetic field is 18×10^{-6} T. At this location, magnetic needle of length 0.12 m and pole strength 1.8 Am is suspended from its mid-point using a thread, it makes 45° angles with horizontal in equilibrium. To keep this needle horizontal, the vertical force that should be applied at one of its ends is:
(1) 1.8×10^{-5} N
(2) 3.6×10^{-5} N
(3) 6.5×10^{-5} N
(4) 1.3×10^{-5} N

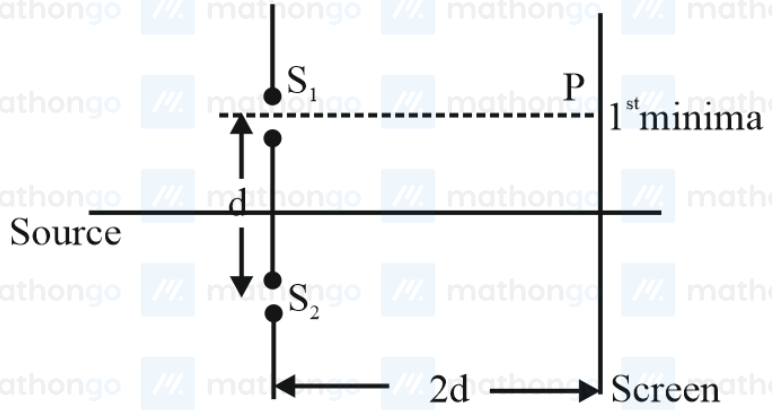
Q23. The self induced emf of a coil is 25 volts. When the current in it is changed at uniform rate from 10A to 25A in 1s , the change in the energy of the inductance is:
(1) 637.5 J
(2) 740 J
(3) 437.5 J
(4) 540 J

Q24. The electric field of a plane polarized electromagnetic wave in free space at time $t = 0$ is given by the expression $\vec{E}(x, y) = 10\hat{j}\cos(6x + 8z)$. The magnetic field $\vec{B}(x, z, t)$ is given by (c is the velocity of light.)
(1) $\frac{1}{c}\left(6\hat{k} - 8\hat{i}\right)\cos(6x + 8z + 10ct)$
(2) $\frac{1}{c}\left(6\hat{k} + 8\hat{i}\right)\cos(6x + 8z - 10ct)$
(3) $\frac{1}{c}\left(6\hat{k} + 8\hat{i}\right)\cos(6x - 8z + 10ct)$
(4) $\frac{1}{c}\left(6\hat{k} - 8\hat{i}\right)\cos(6x + 8z - 10ct)$

Q25. The eye can be regarded as a single refracting surface. The radius of curvature of this surface is equal to that of the cornea (7.8 mm). This surface separates two media of refractive indices 1 and 1.34. Calculate the distance from the refracting surface at which a parallel beam of light will come to focus.

(1) 4 .0 cm (2) 1 cm
(3) 2 cm (4) 3.07 cm

Q26. Consider a Young's double slit experiment as shown in figure. What should be the slit separation d in terms of wavelength λ such that the first minima occurs directly in front of the slit (S_1) ?



(1) $\frac{\lambda}{\left(5-\sqrt{2}\right)}$ (2) $\frac{\lambda}{2\left(\sqrt{5}-2\right)}$
(3) $\frac{\lambda}{2\left(5-\sqrt{2}\right)}$ (4) $\frac{\lambda}{\sqrt{5}-2}$

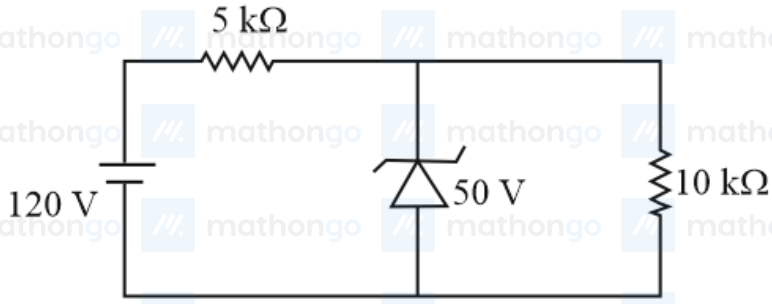
Q27. A metal plate of area $1\times10^{-4}\ m^2$ is illuminated by a radiation of intensity $16\ \frac{milli\,W}{m^2}$. The work function of the metal is $5\ eV$. The energy of the incident photons is $10\ eV$ and only 10% of it produces photo electrons. The number of emitted photo electron per second and their maximum energy, respectively, will be: $\left[1eV=1.6\times10^{-19}J\right]$

(1) 10^{14} and $10\,eV$ (2) 10^{12} and $5\,eV$
(3) 10^{11} and $5\,eV$ (4) 10^{10} and $5\,eV$

Q28. Consider the nuclear fission, $Ne^{20}\rightarrow 2\,He^4+C^{12}$. Given that the binding energy/nucleon of Ne^{20}, He^4 and C^{12} are 8.03 MeV, 7.86 MeV, respectively. Identify the correct statement:

(1) Energy of 12.4 MeV will be supplied. (2) Energy of 9.72 MeV has to be supplied.
(3) Energy of 3.6 MeV will be released. (4) 8.3 MeV energy will be released.

Q29. For the circuit shown below, the current through the Zener diode is



(1) zero. (2) 5 mA.
(3) 9 mA. (4) 14 mA.

Q30. The modulation frequency of an AM radio station is $250kHz$, which is 10% of the carrier wave. If another AM station approaches you for license what broadcast frequency will you allot?

(1) $2750\,kHz$ (2) $2000\,kHz$

(3) $2250\,kHz$ (4) $2900kHz$

Q31. The 71^{st} electron of an element X with an atomic number of 71 enters the orbital:

(1) 5d (2) 4f

(3) 6p (4) 6s

Q32. The ground state energy of a hydrogen atom is -13.6 eV. The energy of second excited state of He^+ ion in eV is:

(1) -27.2 (2) -6.04

(3) -3.4 (4) -54.4

Q33. The process with negative entropy change is:

(1) Synthesis of ammonia from N_2 and H_2. (2) Dissolution of iodine in water.

(3) Dissociation of $CaSO_4$ (s) to CaO (s) and SO_3 (g). (4) Sublimation of dry ice.

Q34. An ideal gas undergoes isothermal compression from 5 m^3 to 1 m^3 against a constant external pressure of 4 N m^{-2}. The heat released in this process is 24 J $mol^{-1}\,K^{-1}$ and is used to increase the pressure of 1 mole of Al. The temperature of Al increases by:

(1) $\frac{2}{3}$ K (2) 1 K

(3) $\frac{3}{2}$ K (4) 2 K

Q35. 5.1 g NH_4SH is introduced in 3.0 L evacuated flask at 327^oC. 30% of the solid NH_4SH is decomposed to NH_3 and H_2S as gases. The K_P of the reaction at 327^oC is

$(R = 0.082\ L\ atm\ mol^{-1}\,K^{-1},\ Molar\ mass\ of\ S = 32\ g\ mol^{-1},\ Molar\ mass\ of\ N = 14\ g\ mol^{-1})$

(1) 0.242 atm^2 (2) 0.242×10^{-4} atm^2

(3) 1×10^{-4} atm^2 (4) 4.9×10^{-3} atm^2

Q36. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is:

(1) 2 (2) 10

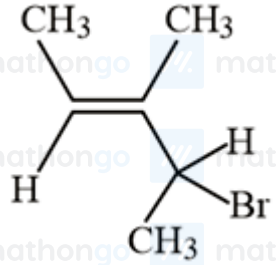
(3) 1 (4) 5

Q37. The number of 2-centre-2-electron and 3-centre-2-electron bonds in B_2H_6, respectively, are:

(1) 4 and 2 (2) 2 and 4

(3) 2 and 2 (4) 2 and 1

Q38. What is the IUPAC name of the following compound?



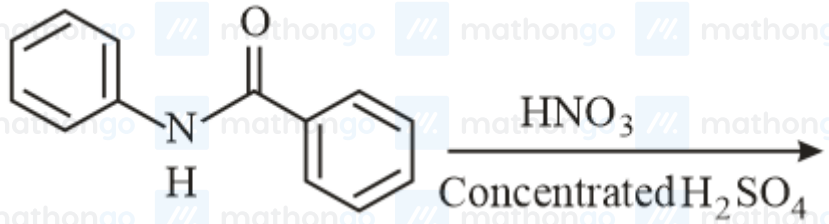
(1) 4−Bromo−3−methylpent−2−ene

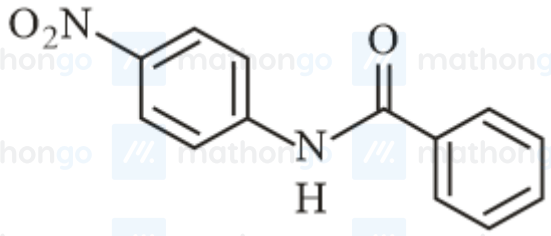
(2) 3−Bromo−3−methyl−1, 2−dimethylprop−1−ene

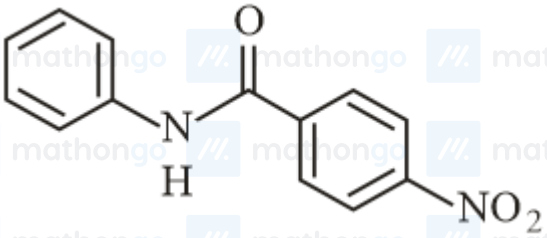
(3) 2−Bromo−3−methyl pent−3−ene

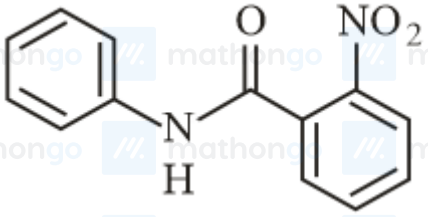
(4) 3−Bromo−1, 2−dimethylbut−1−ene

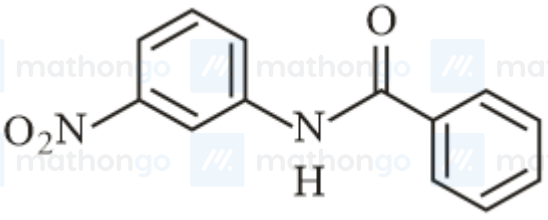
Q39. What will be the major product in the following mononitration reaction?



(1) 

(2) 

(3) 

(4) 

Q40. The reaction that is not involved in the ozone layer depletion mechanism in the stratosphere is

(1) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

(2) $Cl\dot{O}\,(g) + O\,(g) \rightarrow \dot{C}l\,(g) + O_2\,(g)$

(3) $CF_2Cl_2\,(g) \xrightarrow{uv} \dot{C}l\,(g) + \dot{C}F_2Cl\,(g)$

(4) $HOCl\,(g) \xrightarrow{h(nu)} \dot{O}H\,(g) + \dot{C}l\,(g)$

Q41. A compound of formula A_2B_3 has the HCP lattice. Which atom forms the HCP lattice and what fraction of the tetrahedral voids are occupied by the other atoms?

(1) HCP lattice - B
$\frac{2}{3}$tetrahedral voids - A

(2) HCP lattice - A
$\frac{1}{3}$ tetrahedral voids - B

(3) HCP lattice - B
$\frac{1}{3}$ tetrahedral voids - A

(4) HCP lattice - A
$\frac{2}{3}$ tetrahedral voids - B

Q42. The amount of sugar $(C_{12}H_{22}O_{11})$ required to prepare 2L of its 0 .1 M aqueous solution is:

(1) 17 .1 g
(2) 136 .8 g
(3) 68 .4 g
(4) 34 .2 g

Q43. The elevation in boiling point for 1 molal solution of glucose is 2 K. The depression in freezing point for 2 molal solution of glucose in the same solvent is 2 K. The relation between K_b and K_f is:

(1) $K_b = 2\ K_f$
(2) $K_b = 1\ .5\ K_f$
(3) $K_b = K_f$
(4) $K_b = 0\ .5\ K_f$

Q44. In the cell, $Pt(s)|H_2(g,\ 1\ bar)|\ HCl\ (aq)|AgCl(s)|\ Ag(s)|Pt(s)$,the cell potential is 0 .92 V when a 10^{-6} molar HCl solution is used. The standard electrode potential of $Ag\ |\ AgCl\ |\ Cl^-$ electrode is:
(Given, $\frac{2.303RT}{F} = 0\ .06$ V at 298 K)

(1) 0 .76 V
(2) 0 .20 V
(3) 0 .40 V
(4) 0 .94 V

Q45. For an elementary chemical reaction, $A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftarrows}} 2A$, the expression for $\frac{d[A]}{dt}$ is:

(1) $2k_1[A_2] - 2k_{-1}[A]^2$
(2) $2k_1[A_2] - k_{-1}[A]^2$
(3) $k_1[A_2] + k_{-1}[A]^2$
(4) $k_1[A_2] - k_{-1}[A]^2$

Q46. The haemoglobin and the gold sol are examples of

(1) positively charged sols,
(2) negatively and positively charged sols, respectively.
(3) negatively charged sols.
(4) positively and negatively charged sols, respectively.

Q47. The electrolytes usually used in the electroplating of gold and silver, respectively, are:

(1) $[Au(NH_3)_2]^+$ and $[Ag(CN)_2]^-$
(2) $[Au(CN)_2]^-$ and $[AgCl_2]^-$
(3) $[Au(OH)_4]^-$ and $[Ag(OH)_2]^-$
(4) $[Au(CN)_2]^-$ and $[Ag(CN)_2]^-$

Q48. Among the following reactions of hydrogen with halogens, the one that requires a catalyst is:

(1) $H_2 + Cl_2 \rightarrow 2\ HCl$
(2) $H_2 + I_2 \rightarrow 2\ HI$
(3) $H_2 + F_2 \rightarrow 2\ HF$
(4) $H_2 + Br_2 \rightarrow 2\ HBr$

Q49. The pair that contains two $P-H$ bonds in each of the oxoacids is:

(1) H_3PO_3 and H_3PO_2
(2) $H_4P_2O_5$ and H_3PO_3
(3) $H_4P_2O_5$ and $H_4P_2O_6$
(4) H_3PO_2 and $H_4P_2O_5$

Q50. Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of:

(1) Sodamide
(2) Sodium-ammonia complex
(3) Sodium ion-ammonia complex
(4) Ammoniated electrons

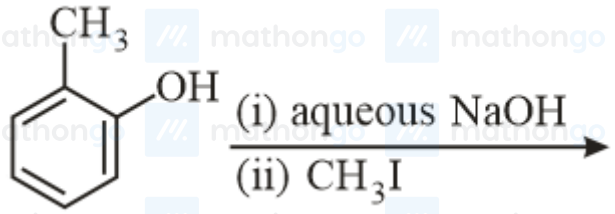
Q51. A reaction of cobalt (III) chloride and ethylenediamine in a 1 : 2 mole ratio generates two isomeric products A (violet-coloured) and B (green-coloured). A can show optical activity, but, B is optically inactive. What type of isomers do A and B represent?

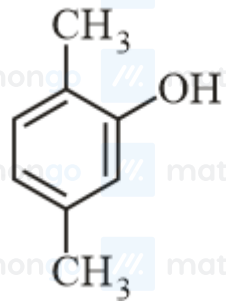
(1) Coordination isomers (2) Linkage isomers
(3) Ionisation isomers (4) Geometrical isomers

Q52. The difference in the number of unpaired electrons of a metal ion in its high-spin and low-spin octahedral complexes is two. The metal ion is:

(1) Fe^{2+} (2) Co^{2+}
(3) Ni^{2+} (4) Mn^{2+}

Q53. The major product of the following reaction is



(1)


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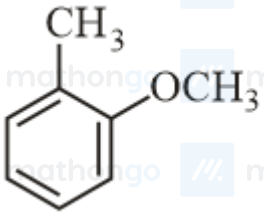

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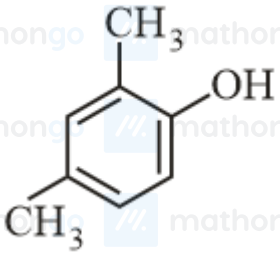

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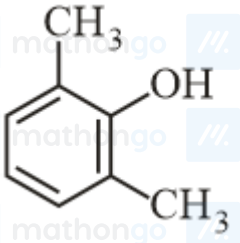
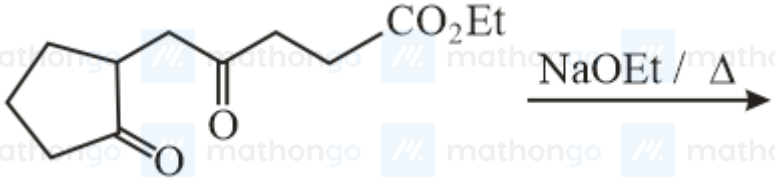
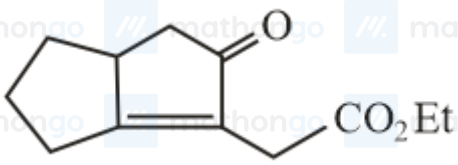
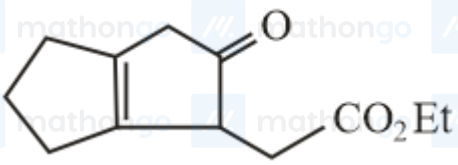
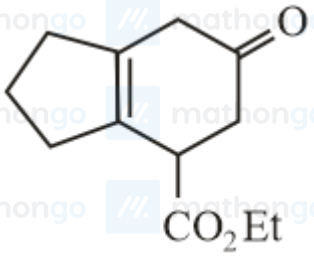


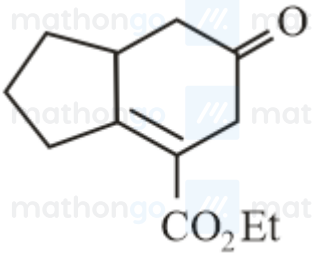
Q54. The major product obtained in the following reaction is:



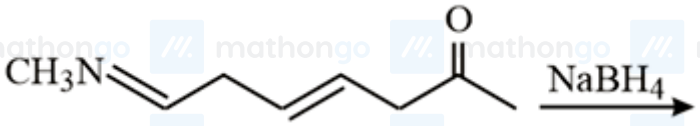
(1) 

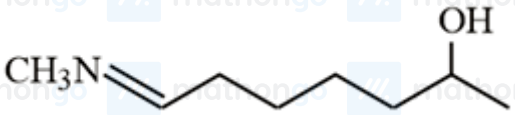
(2) 

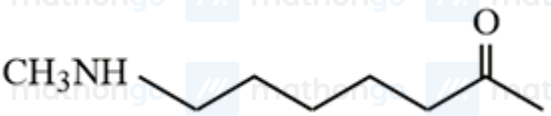
(3) 

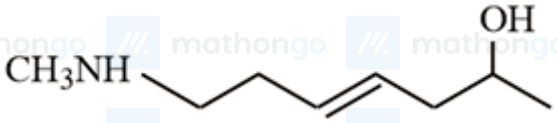
(4) 

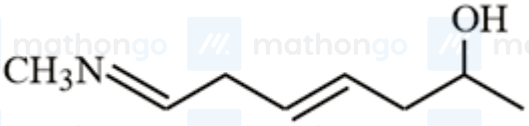
Q55. The major product of the following reaction is:



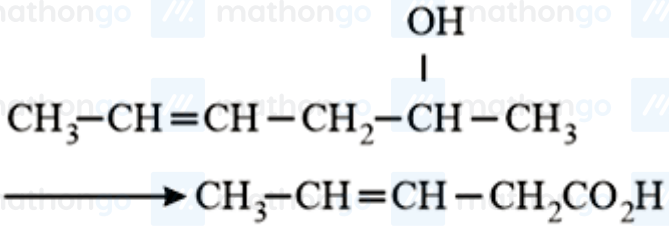
(1) 

(2) 

(3) 

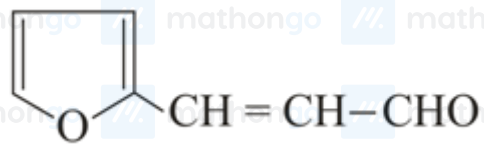
(4) 

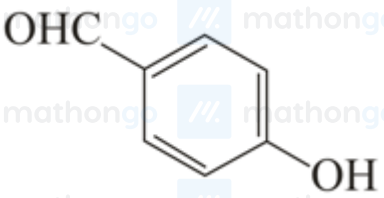
Q56. Which is the most suitable reagent for the following transformation?

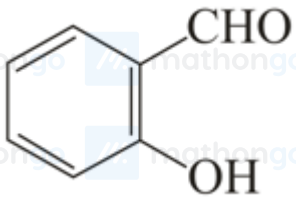


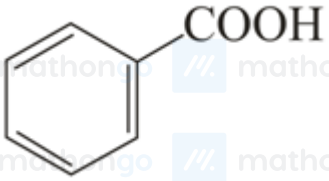
(1) Tollen's reagent
(2) I_2/ NaOH
(3) Alkaline $KMnO_4$
(4) CrO_2Cl_2 / CS_2

Q57. An aromatic compound 'A' having molecular formula $C_7H_6O_2$, on treating with aqueous ammonia and heating forms compound 'B'. The compound 'B' on reaction with molecular bromine and potassium hydroxide provides compound 'C' having molecular formula C_6H_7N. The structure of 'A' is:

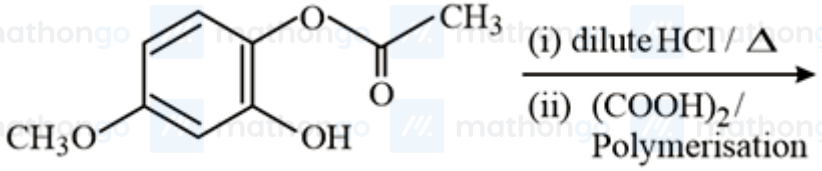
(1) 

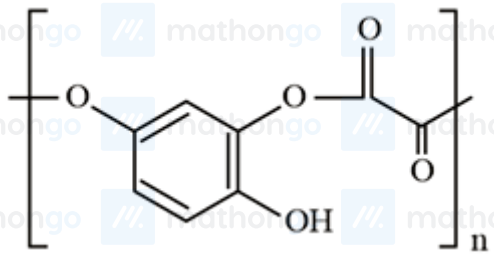
(2) 

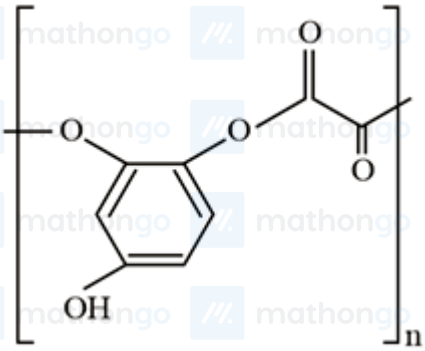
(3) 

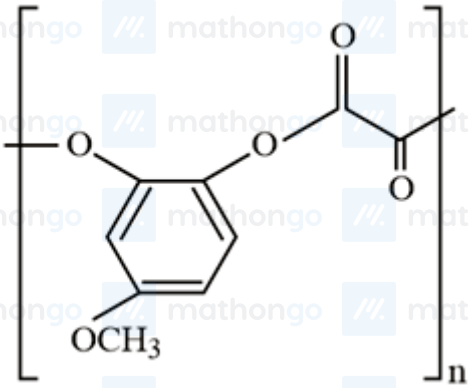
(4) 

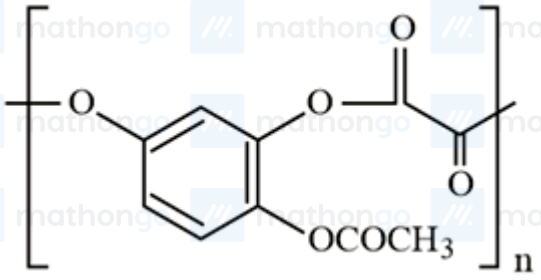
Q58. The major product of the following reaction is:



(1) 

(2) 

(3) 

(4) 

Q59. Which of the following tests cannot be used for identifying amino acids?

(1) Biuret test
(2) Xanthoproteic test
(3) Barfoed test
(4) Ninhydrin test

Q60. The correct match between item I and item II is

Item I (Compound)	Item II (Reagent)
a. Lysine	p. 1−naphthol

b.	Furfural	q.	Ninhydrin
c.	Benzyl alcohol	r.	$KMnO_4$
d.	Styrene	s.	Ceric ammonium nitrate

(1) $a \rightarrow q,\ b \rightarrow r,\ c \rightarrow s,\ d \rightarrow p$
(2) $a \rightarrow q,\ b \rightarrow p,\ c \rightarrow s,\ d \rightarrow r$
(3) $a \rightarrow r,\ b \rightarrow p,\ c \rightarrow q,\ d \rightarrow s$
(4) $a \rightarrow q,\ b \rightarrow p,\ c \rightarrow r,\ d \rightarrow s$

Q61. The value of λ such that sum of the squares of the roots of the quadratic equation, $x^2 + (3 - \lambda)\, x + 2 = \lambda$ has the least value is:
(1) 2
(2) $\frac{4}{9}$
(3) $\frac{15}{8}$
(4) 1

Q62. Let $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$. If $R(z)$ and $I(z)$ respectively denote the real and imaginary parts of z, then
(1) $I(z) = 0$
(2) $R(z) < 0$ and $I(z) > 0$
(3) $R(z) > 0$ and $I(z) > 0$
(4) $R(z) = -3$

Q63. If $\sum_{r=0}^{25} \left\{ \left({}^{50}C_r\right) \left({}^{50-r}C_{25-r}\right) \right\} = K \left({}^{50}C_{25}\right)$, then K is equal to
(1) 2^{25}
(2) $2^{25} - 1$
(3) 2^{24}
(4) $(25)^2$

Q64. The positive value of λ for which the co-efficient of x^2 in the expansion $x^2\left(\sqrt{x} + \frac{\lambda}{x^2}\right)^{10}$ is 720, is
(1) $\sqrt{5}$
(2) 3
(3) 4
(4) $2\sqrt{2}$

Q65. The value of $\cos\frac{\pi}{2^2} \cdot \cos\frac{\pi}{2^3} \cdot \ldots \cdot \cos\frac{\pi}{2^{10}} \cdot \sin\frac{\pi}{2^{10}}$ is:
(1) $\frac{1}{1024}$
(2) $\frac{1}{512}$
(3) $\frac{1}{2}$
(4) $\frac{1}{256}$

Q66. Two vertices of a triangle are $(0, 2)$ and $(4, 3)$. If its orthocenter is at the origin, then its third vertex lies in which quadrant?
(1) Fourth
(2) Second
(3) Third
(4) First

Q67. Two sides of a parallelogram are along the lines, $x + y = 3$ and $x - y + 3 = 0$. If its diagonals intersect at $(2, 4)$, then one of its vertex is:
(1) $(3, 6)$
(2) $(2, 6)$
(3) $(2, 1)$
(4) $(3, 5)$

Q68. If the area of an equilateral triangle inscribed in the circle $x^2 + y^2 + 10x + 12y + c = 0$ is $27\sqrt{3}$ sq. units, then c is equal to:
(1) 25
(2) 13
(3) -25
(4) 20

Q69. The length of the chord of the parabola $x^2 = 4y$ having equation $x - \sqrt{2}y + 4\sqrt{2} = 0$ is

(1) $6\sqrt{3}$ units (2) $8\sqrt{2}$ units
(3) $2\sqrt{11}$ units (4) $3\sqrt{2}$ units

Q70. Let $S = \left\{(x, y) \in R^2 : \frac{y^2}{1+r} - \frac{x^2}{1-r} = 1\right\}$, where $r \neq \pm 1$. Then S represents:

(1) An ellipse whose eccentricity is $\frac{1}{\sqrt{r+1}}$, when $r > 1$.
(2) A hyperbola whose eccentricity is $\frac{2}{\sqrt{r+1}}$, when $0 < r < 1$.
(3) An ellipse whose eccentricity is $\sqrt{\frac{2}{r+1}}$, when $r > 1$
(4) A hyperbola whose eccentricity is $\frac{2}{\sqrt{1-r}}$, when $0 < r < 1$

Q71. Consider the following three statements:
P : 5 is a prime number
Q : 7 is a factor of 192
R : LCM of 5 and 7 is 35
Then the truth value of which one of the following statements is true?

(1) $P \vee (\sim Q \wedge R)$ (2) $(P \wedge Q) \vee (\sim R)$
(3) $(\sim P) \vee (Q \wedge R)$ (4) $(\sim P) \wedge (\sim Q \wedge R)$

Q72. If the mean and standard deviation of 5 observations $x_1,\ x_2,\ x_3,\ x_4,\ x_5$ are 10 and 3, respectively, then the variance of 6 observations $x_1,\ x_2,\ \ldots,\ x_5$ and -50 is equal to

(1) 582.5 (2) 507.5
(3) 509.5 (4) 586.5

Q73. With the usual notation in ΔABC, if $\angle A + \angle B = 120^\circ,\ a = \sqrt{3} + 1$ units and $b = \sqrt{3} - 1$ units, then the ratio $\angle A : \angle B$ is

(1) 7 : 1 (2) 9 : 7
(3) 3 : 1 (4) 5 : 3

Q74. Let $A = \begin{bmatrix} 2 & b & 1 \\ b & b^2+1 & b \\ 1 & b & 2 \end{bmatrix}$, where $b > 0$. Then the minimum value of $\frac{\det(A)}{b}$ is:

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

Q75. The number of values of $\theta \in (0,\ \pi)$ for which the system of linear equations
$x + 3y + 7z = 0$
$-x + 4y + 7z = 0$
$(\sin 3\theta)x + (\cos 2\theta)y + 2z = 0$
has a non-trivial solution, is:

(1) Two (2) Three
(3) Four (4) One

Q76. Let $a_1,\ a_2,\ a_3 \ldots, a_{10}$ be in $G.P.$ with $a_i > 0$ for $i = 1,\ 2,\ \ldots,\ 10$ and S be the set of pairs $(r,\ k),\ r,\ k \in N$ (the set of natural numbers) for which

$$\begin{vmatrix} \log_e a_1^r a_2^k & \log_e a_2^r a_3^k & \log_e a_3^r a_4^k \\ \log_e a_4^r a_5^k & \log_e a_5^r a_6^k & \log_e a_6^r a_7^k \\ \log_e a_7^r a_8^k & \log_e a_8^r a_9^k & \log_e a_9^r a_{10}^k \end{vmatrix} = 0$$

Then the number of elements in S, is:

(1) Infinitely many (2) 4

(3) 10 (4) 2

Q77. The value of $\cot\left(\sum_{n=1}^{19} \cot^{-1}\left(1+\sum_{p=1}^{n} 2p\right)\right)$ is:

(1) $\frac{21}{19}$ (2) $\frac{19}{21}$

(3) $\frac{23}{22}$ (4) $\frac{22}{23}$

Q78. Let N be the set of natural numbers and two functions f and g be defined as $f, g : N \to N$ such that

$$f(n) = \begin{cases} \frac{n+1}{2}, & if\ n\ is\ odd \\ \frac{n}{2}, & if\ n\ is\ even \end{cases}$$

and $g(n) = n - (-1)^n$. Then fog is:

(1) onto but not one-one (2) Both one-one and onto

(3) One-one but not onto (4) Neither one-one nor onto

Q79. Let $f : (-1,\ 1) \to R$ be a function defined by $f(x) = max\left\{-|x|,\ -\sqrt{1-x^2}\right\}$. If K be the set of all points at which f is not differentiable, then K has exactly

(1) two elements (2) one element

(3) three elements (4) five elements

Q80. A helicopter is flying along the curve given by $y - x^{\frac{3}{2}} = 7,\ (x \geq 0)$. A soldier positioned at the point $\left(\frac{1}{2},\ 7\right)$, who wants to shoot down the helicopter when it is nearest to him. Then this nearest distance is:

(1) $\frac{1}{6}\sqrt{\frac{7}{3}}$ (2) $\frac{1}{2}$

(3) $\frac{1}{3}\sqrt{\frac{7}{3}}$ (4) $\frac{\sqrt{5}}{6}$

Q81. The tangent to the curve, $y = xe^{x^2}$ passing through the point $(1, e)$ also passes through the point:

(1) $\left(\frac{4}{3},\ 2e\right)$ (2) $(2,\ 3e)$

(3) $\left(\frac{5}{3},\ 2e\right)$ (4) $(3,\ 6e)$

Q82. If $\int x^5 e^{-4x^3} dx = \frac{1}{48} e^{-4x^3} f(x) + C$, where C is a constant of integration, then $f(x)$ is equal to

(1) $-4x^3 - 1$ (2) $-2x^3 + 1$

(3) $-2x^3 - 1$ (4) $4x^3 + 1$

Q83. The value of $\int\limits_{-\pi/2}^{\pi/2} \frac{dx}{[x]+[\sin x]+4}$, where $[t]$ denotes the greatest integer less than or equal to t, is

(1) $\frac{3}{20}(4\pi - 3)$ (2) $\frac{3}{10}(4\pi - 3)$

(3) $\frac{1}{12}(7\pi - 5)$ (4) $\frac{1}{12}(7\pi + 5)$

Q84. If $\int\limits_0^x f(t)dt = x^2 + \int\limits_x^1 t^2 f(t)dt$, then $f'\left(\frac{1}{2}\right)$ is

(1) $\frac{18}{25}$ (2) $\frac{24}{25}$
(3) $\frac{4}{5}$ (4) $\frac{6}{25}$

Q85. A curve amongst the family of curves represented by the differential equation, $\left(x^2-y^2\right)\,dx+2xy\,dy=0$ which passes through $(1,1)$, is

(1) A circle with centre on the $x-$ axis. (2) A circle with centre on the $y-$ axis.
(3) A hyperbola with transverse axis along the $x-$ axis. (4) An ellipse with major axis along the $y-$ axis.

Q86. Let $f(x)$ be a differentiable function such that $f'(x)=7-\frac{3}{4}\frac{f(x)}{x},\ (x>0)$ and $f(1)\neq 4$. Then $\lim\limits_{x\to 0^+} x\,f\left(\frac{1}{x}\right)$

(1) does not exist. (2) exists and equals 4.
(3) exists and equals $\frac{4}{7}$. (4) exists and equals 0.

Q87. Let $\vec{\alpha}=(\lambda-2)\vec{a}+\vec{b}$ and $\vec{\beta}=(4\lambda-2)\vec{a}+3\vec{b}$, be two given vectors where vectors $\vec{a}$ and $\vec{b}$ are non-collinear. The value of λ for which vectors $\vec{\alpha}$ and $\vec{\beta}$ are collinear, is:

(1) -4 (2) -3
(3) 4 (4) 3

Q88. The plane which bisects the line segment joining the points $(-3,\ -3,\ 4)$ and $(3,\ 7,\ 6)$ at right angles, passes through which one of the following points?

(1) $(2,\ 1,\ 3)$ (2) $(4,\ 1,\ -2)$
(3) $(4,\ -1,\ 7)$ (4) $(-2,\ 3,\ 5)$

Q89. On which of the following lines lies the point of intersection of the line, $\frac{x-4}{2}=\frac{y-5}{2}=\frac{z-3}{1}$ and the plane, $x+y+z=2$?

(1) $\frac{x-4}{1}=\frac{y-5}{1}=\frac{z-5}{-1}$ (2) $\frac{x-1}{1}=\frac{y-3}{2}=\frac{z+4}{-5}$
(3) $\frac{x-2}{2}=\frac{y-3}{2}=\frac{z+3}{3}$ (4) $\frac{x+3}{3}=\frac{4-y}{3}=\frac{z+1}{-2}$

Q90. If the probability of hitting a target by a shooter, in any shot is $\frac{1}{3}$, then the minimum number of independent shots at the target required by him so that the probability of hitting the target at least once is greater than $\frac{5}{6}$, is:

(1) 4 (2) 5
(3) 6 (4) 3

ANSWER KEYS

1. (3)	**2.** (1)	**3.** (1)	**4.** (2)	**5.** (2)	**6.** (3)	**7.** (4)	**8.** (3)
9. (3)	**10.** (1)	**11.** (3)	**12.** (2)	**13.** (1)	**14.** (3)	**15.** (3)	**16.** (1)
17. (3)	**18.** (3)	**19.** (3)	**20.** (2)	**21.** (3)	**22.** (3)	**23.** (3)	**24.** (4)
25. (4)	**26.** (3)	**27.** (3)	**28.** (2)	**29.** (3)	**30.** (2)	**31.** (1)	**32.** (2)
33. (1)	**34.** (1)	**35.** (1)	**36.** (3)	**37.** (1)	**38.** (1)	**39.** (1)	**40.** (1)
41. (3)	**42.** (3)	**43.** (1)	**44.** (2)	**45.** (1)	**46.** (4)	**47.** (4)	**48.** (2)
49. (4)	**50.** (4)	**51.** (4)	**52.** (2)	**53.** (2)	**54.** (1)	**55.** (3)	**56.** (2)
57. (4)	**58.** (2)	**59.** (3)	**60.** (2)	**61.** (1)	**62.** (1)	**63.** (1)	**64.** (3)
65. (2)	**66.** (2)	**67.** (1)	**68.** (1)	**69.** (1)	**70.** (3)	**71.** (1)	**72.** (2)
73. (1)	**74.** (1)	**75.** (1)	**76.** (1)	**77.** (1)	**78.** (1)	**79.** (3)	**80.** (1)
81. (1)	**82.** (1)	**83.** (1)	**84.** (2)	**85.** (1)	**86.** (2)	**87.** (1)	**88.** (2)
89. (2)	**90.** (2)						