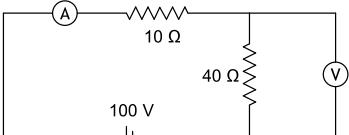
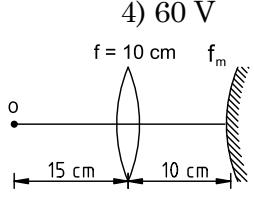
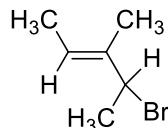


2019

*Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE is correct.
For correct answer +4 marks awarded. No negative marks.*

12. Statement I: Two similar triangles of equal area are congruent.
 Statement II: ABCD is a square. Area of the equilateral triangle having one of its sides as AC is equal to $\sqrt{2}$ times the area of the equilateral triangle having one of its sides as AB.
- 1) Both the statements are true 2) Statement I is true, Statement II is false
 3) Statement I is false, Statement II is true 4) Both the statements are false
13. One end of a diameter of a circle having centre at $(-2, 5)$ is $(2, 3)$. The other end of the diameter is
 1) $(2, -5)$ 2) $(-6, 7)$ 3) $(0, 2)$ 4) $(0, -2)$
14. If a trapezium is cyclic then
 1) its parallel sides are equal 2) its non parallel sides are equal
 3) its diagonals are not equal 4) it must be a rectangle
15. The points $(a, 0)$, $(0, a)$, $(-a, 0)$ and $(0, -a)$ are the vertices of a
 1) square 2) parallelogram but not a rhombus
 3) rectangle but not a square 4) rhombus but not a square
16. Suppose O is the circumcentre of ΔABC such that O lies inside the triangle. If angle BOA is 110° and angle COA is 90° then angle BAC is
 1) 20° 2) 60° 3) 80° 4) 40°
17. If $f(x) = \frac{x^4 + x^2 + 1}{x^2 - x + 1}$, then the minimum value of $f(x)$ is
 1) $1/4$ 2) $3/4$ 3) $-1/4$ 4) $-3/4$
18. Two equal circles having centres at A and B are intersecting in two points P and Q. If $AB = 8$ and $PQ = 6$ then the radius of the circles is
 1) 2 2) 4 3) 5 4) 7
19. When $x^4 + ax^3 + 5x^2 + 8x - 31$ is divided by $x - 2$ the remainder is 5 then a is
 1) 3 2) -2 3) 2 4) 5
20. If $f(x) = 2(\sin^6 x + \cos^6 x) - 3(\cos^4 x + \sin^4 x)$, the value of $f(\pi/8) - 3f(3\pi/8) =$
 1) 1 2) -1 3) 2 4) 0
21. Notation: $\prod_{i=1}^k x_i = x_1 \cdot x_2 \dots \cdot x_k$. If $x = \prod_{r=1}^{89} \log_e \tan r^0$ and $y = \prod_{r=1}^{89} \log_e \cot r^0$
 then $\cos(x^2 - y^2 + 3xy)$ is equal to
 1) 0 2) 1 3) -1 4) $1/2$
22. If the sides of a triangle are 7, 24, 25, then the distance between its circumcentre and orthocentre of the triangle is
 1) 7 2) 12 3) 12.5 4) 28
23. The number of numbers from 1 to 100 each of which is not only exactly divisible by 4 but also has 4 as a digit is
 1) 7 2) 10 3) 20 4) 21
24. In a trapezium the lengths of the parallel sides are 10 and 24. P, Q are the mid points of the non parallel sides. If the line PQ intersects the diagonals in R and S then RS is equal to
 1) 5 2) 12 3) 16 4) 7
25. The average weight of a class of 29 students is 49 kgs. If the weight of the teacher be included, the average raises by 500 gms. The weight of the teacher is
 1) 45 kg 2) 55 kg 3) 62 kg 4) 64kg

39. Electromagnetic radiations in the increasing order of wavelength from the following is
 1) Infrared waves, radio waves, x rays, visible light
 2) radio waves, Infrared waves, visible light, x rays
 3) x rays , visible light, Infrared waves, radio waves
 4) radio waves, visible light, Infrared waves, x rays
40. The angle of minimum deviation of an equilateral prism is 30° . The velocity of light inside the prism is (velocity of light in vacuum = $3 \times 10^8 \text{ ms}^{-1}$)
 1) $1.8 \times 10^8 \text{ ms}^{-1}$ 2) $2 \times 10^8 \text{ ms}^{-1}$ 3) $2.121 \times 10^8 \text{ ms}^{-1}$ 4) $7.07 \times 10^7 \text{ ms}^{-1}$
41. The resistivity of the material of a wire is $10^{-7} \Omega\text{m}$. If the wire is stretched to increase its length by 50%, then its resistivity will be (assume stretching does not change the temperature)
 1) $10^{-7} \Omega\text{ m}$ 2) $1.5 \times 10^{-7} \Omega\text{ m}$ 3) $2.25 \times 10^{-7} \Omega\text{ m}$ 4) $2 \times 10^{-7} \Omega\text{ m}$
42. The reading of the ammeter (below, left) in the circuit (Assume voltmeter and ammeter are ideal) is
 1) 2 A 2) 1A 3) 3 A 4) 4 A
43. In the previous question, reading of the voltmeter is
 1) 20 V 2) 40 V 3) 80 V 4) 60 V
- 
- 
44. A convex lens of focal length 10 cm and a convex mirror of focal length f_m are mounted coaxially (above, right). The image of a point object located on the axis 15 cm to the left of the lens coincides with the object itself. Focal length f_m of the mirror is
 1) 5 cm 2) 10 cm 3) 15 cm 4) 20 cm
45. In the previous question if the mirror is removed, the distance between the image and object will be
 1) 30 cm 2) 45 cm 3) 60 cm 4) 75 cm
46. A long straight horizontal wire carries a current from south to north. Magnetic field vertically above the wire is directed
 1) westward 2) eastward 3) northward 4) southward
47. All atoms of same element must have same
 1) number of neutrons 2) number of nucleons
 3) atomic number 4) mass number
48. A charged particle is moving in a magnetic field at right angles to the field in a circular path of radius R. If a particle with same charge and twice greater mass were to be moving with half the velocity in the same magnetic field with its velocity at right angles to the field, the radius of its circular path would be
 1) $2R$ 2) R 3) $3R$ 4) $4R$
49. A radionuclide of atomic mass 300 amu on fission liberates 200 MeV of energy. The energy liberated when 1 g of this radionuclide undergoes fission is (given Avogadro number = 6×10^{23})
 1) $6.4 \times 10^{10} \text{ J}$ 2) $6.4 \times 10^{11} \text{ J}$ 3) $6.4 \times 10^{12} \text{ J}$ 4) $6.4 \times 10^{13} \text{ J}$
50. A nuclear reactor operates using the fissionable material mentioned in the previous question. If it were to use 540 g of the material in a day, its power would be (assume 50% efficiency in conversion of energy released in the fission in to electrical energy)
 1) 100 MW 2) 200 MW 3) 300 MW 4) 400 MW



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

- 1) 3-Bromo-1,2-dimethylbut-1-ene
- 2) 4-Bromo-3-methylpent-2-ene
- 3) 2-Bromo-3-methylpent-3-ene
- 4) 3-Bromo-3-methyl-1,2-dimethylprop-1-ene

52. Iodine reacts with concentrated HNO_3 to yield Y along with other products. The oxidation state of iodine in Y, is:-

- 1) 5
- 2) 3
- 3) 1
- 4) 7

53. In a chemical reaction, $\text{A} + 2\text{B} \rightleftharpoons 2\text{C} + \text{D}$, the initial concentration of B was 1.5 times of the concentration of A, but the equilibrium concentrations of A and B were found to be equal. The equilibrium constant (K) for the aforesaid chemical reaction is:

- 1) 16
- 2) 4
- 3) 1
- 4) $\frac{1}{4}$

54. 50mL of 0.5 M oxalic acid is needed to neutralize 25mL of sodium hydroxide solution. The amount of NaOH in 500 mL of the given sodium hydroxide solution is :

- 1) 40 g
- 2) 20 g
- 3) 80 g
- 4) 10 g

55. The metal that forms nitride by reacting directly with N_2 of air, is :

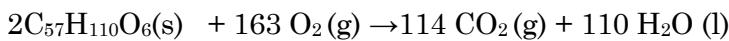
- 1) K
- 2) Cs
- 3) Li
- 4) Rb

56. For the reaction, $2\text{A} + \text{B} \rightarrow \text{Products}$, when the concentrations of A and B both were doubled, the rate of the reaction increased from $0.3 \text{ mol L}^{-1}\text{S}^{-1}$ to $2.4 \text{ mol L}^{-1}\text{S}^{-1}$. When the concentration of A alone is doubled, the rate increased from $0.3 \text{ mol L}^{-1}\text{S}^{-1}$ to $0.6 \text{ mol L}^{-1}\text{S}^{-1}$

Which one of the following statements is correct?

- 1) Order of the reaction with respect to B is 2
- 2) Order of the reaction with respect to A is 2
- 3) Total order of the reaction is 4
- 4) Order of the reaction with respect to B is 1

57. For the following reaction, the mass of water produced from 445 g of $\text{C}_{57}\text{H}_{110}\text{O}_6$ is :



- 1) 495 g
- 2) 490 g
- 3) 890 g
- 4) 445 g

58. When the first electron affinity of oxygen is -141 kJ/mol , its second electron affinity is ;

- 1) almost the same as that of the first
- 2) negative, but less negative than the first
- 3) a positive value
- 4) a more negative value than the first

59. An open vessel at 27°C is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature at which the vessel has been heated is :

- 1) 750°C
- 2) 500°C
- 3) 750 K
- 4) 500 K

60. If K_{sp} of Ag_2CO_3 is 8×10^{-12} , the molar solubility of Ag_2CO_3 in 0.1 M AgNO_3 is :

- 1) $8 \times 10^{-12} \text{ M}$
- 2) $8 \times 10^{-10} \text{ M}$
- 3) $8 \times 10^{-11} \text{ M}$
- 4) $8 \times 10^{-13} \text{ M}$

61. Chlorine on reaction with hot and concentrated sodium hydroxide gives :

- 1) Cl^- and ClO_2^-
- 2) Cl^- and ClO_3^-
- 3) Cl^- and ClO^-
- 4) ClO_3^- and ClO_2^-

62. 0.5 moles of gas A and x moles of gas B exert a pressure of 200 Pa in a container of volume 10 m^3 at 1000 K. Given R is the gas constant in $\text{JK}^{-1} \text{mol}^{-1}$, x is :

- 1) $\frac{2R}{4+R}$
- 2) $\frac{2R}{4-R}$
- 3) $\frac{4-R}{2R}$
- 4) $\frac{4+R}{2R}$

63. In general, the properties that decrease and increase down a group in the periodic table, respectively are :
- 1) electronegativity and electron gain enthalpy
 - 2) electronegativity and atomic radius
 - 3) atomic radius and electronegativity
 - 4) electron gain enthalpy and electronegativity
64. The hydride that is NOT electron deficient is:
- 1) B_2H_6
 - 2) AlH_3
 - 3) SiH_4
 - 4) GaH_3
65. Match the following items in column I with the corresponding items in column II
- | | COLUMN I | | COLUMN II |
|------|---|----|----------------------------|
| i) | $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ | P) | Portland cement ingredient |
| ii) | $\text{Mg}(\text{HCO}_3)_2$ | Q) | Castner-Keller process |
| iii) | NaOH | R) | Solvay process |
| iv) | $\text{Ca}_3\text{Al}_2\text{O}_6$ | S) | Temporary hardness |
- 1) i)→R; ii)→Q; iii)→S; iv)→P 2) i)→R; ii)→S; iii)→Q; iv)→P
 3) i)→S; ii)→P; iii)→Q; iv)→R 4) i)→Q; ii)→R; iii)→P; iv)→S
66. 25 ml of the given HCl solution requires 30 ml of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 ml of 0.2 M aqueous NaOH solution?
- 1) 25 ml
 - 2) 50 ml
 - 3) 12.5 ml
 - 4) 75 ml
67. The correct order of the atomic radii of C,Cs,Al and S is :
- 1) $\text{S} < \text{C} < \text{Al} < \text{Cs}$
 - 2) $\text{S} < \text{C} < \text{Cs} < \text{Al}$
 - 3) $\text{C} < \text{S} < \text{Cs} < \text{Al}$
 - 4) $\text{C} < \text{S} < \text{Al} < \text{Cs}$
68. The pair that does NOT require calcinations is :
- 1) ZnO and MgO
 - 2) Fe_2O_3 and $\text{CaCO}_3 \cdot \text{MgCO}_3$
 - 3) ZnO and $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$
 - 4) ZnCO_3 and CaO
69. 5 moles of AB_2 weigh 125×10^{-3} kg and 10 moles of A_2B_2 weigh 300×10^{-3} kg. The molar mass of A(M_A) and molar mass of B(M_B) in kg mol⁻¹ are:
- 1) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$
 - 2) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$
 - 3) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$
 - 4) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$
70. The mole fraction of a solvent in aqueous solution of a solute is 0.8. The molality (in mol kg⁻¹) of the aqueous solution is
- 1) 13.88×10^{-1}
 - 2) 13.88×10^{-2}
 - 3) 13.88
 - 4) 13.88×10^{-3}