MATHEMATICS

1. If $a = -1 + \sqrt{2}$, then the value of $\left(a + \frac{1}{a}\right)$ is

   (A) $2\sqrt{2}$

   (B) $-2\sqrt{2}$

   (C) 2

   (D) -2

2. If $x - a$ is a factor of $x^3 - ax^2 + 2x + (a+3)$, then the value of a is

   (A) $\sqrt{3}$

   (B) $-\sqrt{3}$

   (C) -1

   (D) 2

3. If $x - 3$ and $x - \frac{1}{3}$ are both factors of $ax^2 + 5x + b$, then

   (A) $a = 2b$

   (B) $a = b$

   (C) $a + b = 0$

   (D) $a + 2b = 0$

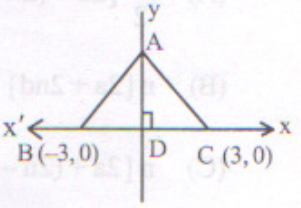
4. In the figure, if ABC is an equilateral Δ with B (–3, 0) and C(3, 0), then the coordinates of A are

   (A) (–1, 1)

   (B) $(-\frac{3}{2}, 0)$

   (C) $(\frac{3}{2}, 0)$

   (D) $(0, 3\sqrt{3})$



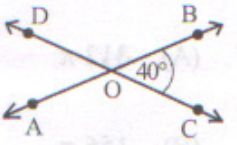
5. From the figure, $\angle BOD + \angle AOC$ equals

   (A) 40°

   (B) 90°

   (C) 180°

   (D) 280°



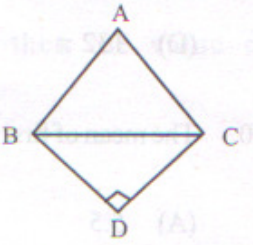
6. In the figure, ABC is an equilateral triangle and BDC is a right-angled isosceles triangle. $\angle ABD$ equals

   (A) 45°

   (B) 60°

   (C) 105°

   (D) 15°



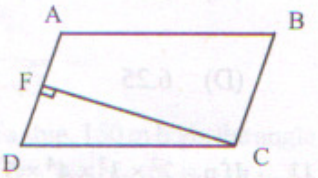
7. In the figure, area of parallelogram ABCD = 56 cm^2 and CF $\perp$ AD. If CF = 7 cm, then the length of AD is

   (A) 14 cm

   (B) 8 cm

   (C) 7 cm

   (D) 28 cm



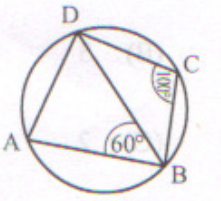
8. In the figure, ABCD is a cyclic quadrilateral. If $\angle BCD = 100°$ and $\angle ABD = 60°$, then $\angle ADB$ equals

   (A) 80°

   (B) 60°

   (C) 40°

   (D) 30°



9. If the diameter of base of a right circular cone is 24 cm and its height is 5 cm, then the curved surface area of the cone (in terms of cm^2) is

(A) 312π

(B) 156π

(C) 78π

(D) 132π

10. The mean of first 10 natural numbers is

(A) 5.5

(B) 5.0

(C) 6.5

(D) 6.25

11. If $n = 2^2 \times 3^3 \times 4^4 \times 5^3$, then the number of zeros in the expanded form of n is

(A) 4

(B) 3

(C) 2

(D) 5

12. If $2x^2 - 5x = -2$, then the value of $x + \frac{1}{x}$ is

(A) -5

(B) $-\frac{5}{2}$

(C) $\frac{5}{2}$

(D) 5

13. If $2a + b = 3$ and $4a - b = 9$, then $(a + b)$ equals

(A) 3

(B) 2

(C) 1

(D) -1

14. The sum of first 2n terms of an A.P. $a, a + d, a + 2d, \ldots$ is

(A) $\frac{n}{2}[2a + (n-1)d]$

(B) $n[2a + 2nd]$

(C) $n[2a + (2n-1)d]$

(D) $n[2a + (\overline{n-1})d]$

15. In a right-angled triangle, the square on the hypotenuse is equal to twice the product of other two sides, then one of the acute angles of the triangle is

(A) 30°

(B) 45°

(C) 60°

(D) 90°

16. If (1, 2), (4, y), (x, 6) and (3, 5) are the coordinates of the vertices of a parallelogram, taken in order, then (x + y) equals

(A) 3

(B) 9

(C) −3

(D) −9

17. If the radii of the circular ends of a frustum of a cone, of height 28 cm, arc 35 cm and 14 cm, then the slant height of the frustum is

(A) 25 cm

(B) 30 cm

(C) 35 cm

(D) 45 cm

18. A number x is chosen at random from the numbers −4, −3, −2, −1, 0, 1, 2, 3, then the probability that $|x| < 2$ is

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

(B) $\frac{4}{7}$

(C) $\frac{5}{8}$

(D) $\frac{3}{9}$

19. If $\sin A = \frac{1}{2}$, then the value of $\cot A + \frac{\sin A}{1+\cos A}$ is

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

(B) 2

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

(D) $\sqrt{3}+\frac{3}{2-\sqrt{3}}$

20. From the top of a ship, 150 m high, the angle of depression of a boat is observed to be 30°. The distance of the boat from the ship is

(A) $150\sqrt{3}$ m

(B) $50\sqrt{3}$ m

(C) $\left(50+\sqrt{3}\right)$ m

(D) $\left(150-\sqrt{3}\right)$ m

21. The distances travelled by a body falling freely from rest in the first, second and third seconds respectively are in the ratio

(A) 1 : 4 : 9

(B) 1 : 2 : 3

(C) 1 : 9 : 25

(D) 1 : 3 : 5

22. Which of the following is a scalar quantity ?

(A) Force

(B) Energy

(C) Velocity

(D) Area

23. A body whose momentum is constant must always

(A) be accelerated

(B) decelerated

(C) be moving in a circle

(D) be having constant velocity

24. If the radius of the earth were to be increased by a factor of 3, by what factor would its density have to be changed to keep 'g' the same ?

(A) 3

(B) $\frac{1}{3}$

(C) 6

(D) $\frac{1}{6}$

25. A force of 5 N acts on an object. The 1 metre displacement of the object is perpendicular to the direction of the force. The work done is

(A) 5 J

(B) 1 J

(C) 100 N

(D) zero

26. Which one of the following properties of sound is affected by change in the air temperature ?

(A) Frequency

(B) Amplitude

(C) Intensity

(D) Wavelength

27. A pipe opened at both ends has a fundamental frequency 'n'. If one of the ends is closed, its fundamental frequency becomes

(A) $\frac{n}{2}$

(B) 2n

(C) $\frac{n}{3}$

(D) $\frac{n}{4}$

28. If 'm' is the longitudinal magnification produced by a spherical mirror, then the lateral magnification will be

(A) 2m

(B) m

(C) $\sqrt{m}$

(D) m^2

29. When a plane mirror is rotated through an angle θ, the reflected ray turns through the angle 2θ. The size of the image

(A) is halved

(B) is doubled

(C) remains the same

(D) becomes infinite

30. Signals of danger are made in red because

(A) scattering is minimum for red colour

(B) scattering is maximum for red colour

(C) our eye is most sensitive to red colour

(D) red colour is internationally accepted symbol for danger

31. A concave lens forms the image of an object which is

(A) virtual, inverted and diminished

(B) virtual, upright and enlarged

(C) virtual, upright and diminished

(D) real, inverted and enlarged

32. What is irrelevant for an electric fuse ?

(A) Specific resistance

(B) Radius

(C) Length

(D) Current flowing through it

33. If 'q' is the heat dissipated per second by a resistor maintained at a constant temperature and 'p' is the potential difference across the resistor, then 'q' is proportional to

(A) p

(B) p^2

(C) $\sqrt{p}$

(D) $\frac{1}{p}$

34. Three 2-ohm resistors are arranged in a triangle. What is the resistance between any two corners ?

(A) 3 ohms

(B) $\frac{3}{4}$ ohm

(C) 4 ohms

(D) $\frac{4}{3}$ ohm

35. For making an electromagnet the best material to be used is

(A) stainless steel

(B) silver

(C) soft iron

(D) nickel

36. Fleming's right-hand rule gives

(A) the magnitude of the induced e.m.f.

(B) the magnitude of the magnetic field

(C) the direction of the induced e.m.f.

(D) both magnitude and direction of the induced e.m.f.

37. Destructive distillation of coal leads to the foundation of

(A) wood

(B) kerosene

(C) ammoniacal liquor

(D) charcoal

38. Choose the source of energy which is different from others

(A) Lignite

(B) Natural gas

(C) Sun

(D) Coal

39. Which of the following is the smallest planet?

(A) Jupiter

(B) Venus

(C) Mercury

(D) Pluto

40. The earth rotates on its axis from

(A) West to East

(B) East to West

(C) North to South

(D) South to North

41. The symbol $^{65}_{30}X$ indicates that this isotope of the element X contains

(A) 30 protons and 35 neutrons

(B) 35 protons and 30 neutrons

(C) 35 protons and 35 neutrons

(D) 30 protons and 65 neutrons

42. Which one of the following is a polar molecule ?

(A) CO_2

(B) CH_4

(C) HCl

(D) C_2H_4

43. Which one of the following ions will be largest in size ?

(A) Li^+

(B) O^{2-}

(C) Na^+

(D) S^{2-}

44. Which one of the following is *incorrect* in relation to periodic table ?

(A) Atomic radius of elements decreases along a period from left to right

(B) Ionization energy of elements decreases in a group from top to bottom

(C) Atomic radius of elements increases down to group

(D) Ionization energy of elements decreases along a period

45. A drop of water weighs 0.018 g. Number of water molecules present in it will be (Avogadro' constant, $N_A = 6.02 \times 10^{23}$ mol^{-1})

(A) 6.02×10^{22}

(B) 6.02×10^{20}

(C) 6.02×10^{18}

(D) 6.02×10^{21}

46. HCl concentration is 1×10^{-4} M. The pH of the solution is

(A) 1

(B) 4

(C) 6

(D) 8

47. 3 Faraday of electricity is passes through a copper sulphate solution. If the reaction at the cathode is

$$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s),$$

the amount of the copper deposited at the cathode will be

(A) 3 mol

(B) 2 mol

(C) 1.5 mol

(D) 2.5 mol

48. Which of the following entities represents cathode rays ?

(A) He^{2+}

(B) e^-

(C) H

(D) p^+

(e^- = electron and p^+ = proton)

49. Which one of the following species is isoelectronic with phosphorus atom ? (X represents a symbol of an element and atomic number of phosphorus is 15)

(A) $_{15}X^{3-}$

(B) $_{15}X^{3+}$

(C) $_{16}X^{+}$

(D) $_{15}X^{2+}$

50. Which one of the following is ore of mercury from which mercury can be obtained by direct heating ?

(A) Calamine

(B) Cinnabar

(C) Bauxite

(D) Sphalerite

51. Which one of the following statements is *not* correct regarding metals and non-metals ?

(A) Metals generally form basic oxides

(B) Non-metals generally form acidic oxides

(C) Metals are good conductors of heat and electricity

(D) Metals generally do not dissolve in mineral acids

52. Permanent hardness of water is due to the presence of

(A) Soluble bicarbonates of calcium and magnesium

(B) Sodium and potassium carbonates

(C) Soluble chlorides and sulphates of calcium and magnesium

(D) Calcium bicarbonate and sodium hydroxides

53. Raw materials used for manufacture of sodium carbonate are

(A) NaCl and $CaCO_3$

(B) NaCl, NH_3 and CO_2

(C) NaCl and NH_4OH

(D) NaCl and CO_2

54. Which of the following alloys is prepared out of copper and zinc only ?

(A) Bronze

(B) German Silver

(C) Brass

(D) Bell metal

55. Which one of the following is *not* a potential natural source of organic compounds ?

(A) Coal

(B) Petroleum

(C) Natural gas

(D) Limestone

56. General formula of a carboxylic acid can be written as :

(A) $R-\overset{\overset{O}{\|}}{C}-H$

(B) $R-\overset{\overset{O}{\|}}{C}-R$

(C) $R-\overset{\overset{O}{\|}}{C}-OH$

(D) $R-\overset{\overset{O}{\|}}{C}-OR$

57. IUPAC name of the compound

$CH_3CH(OH)CH_3$

is

(A) 1-propanol

(B) 2-propanol

(C) propanol

(D) 1,2-propanol

58. Calorific value of a fuel is defined as

(A) heat liberated when 1 mol of a fuel is burnt in oxygen

(B) heat liberated on burning 1 gram of a fuel in sufficient quantity of oxygen

(C) heat liberated when 1 kilogram of a fuel is burnt in excess of air

(D) heat liberated when 1 kg of fuel is burnt in presence of 1 kg of oxygen

59. Soap is chemically

(A) a sodium or potassium salt of higher fatty acids

(B) an ester of alcohol and carboxylic acid

(C) a salt of strong acid and sodium hydroxide

(D) a salt of a weak acid and a strong base

60. In a homologous series of hydrocarbon, the third member is C_3H_8. The formula of the seventh member of series will be

(A) C_7H_{12}

(B) C_7H_{14}

(C) C_7H_{16}

(D) C_7H_{18}

61. A person was found to be taking injections of insulin on the advise of his doctor. From which disease he was likely to be suffering from ?

(A) Goitre

(B) High blood pressure

(C) Diabetes

(D) Low blood pressure

62. Growing two or more crops simultaneously on same field in a definite pattern is called

(A) Crop rotation

(B) Mixed cropping

(C) Intensive cropping

(D) Intercropping

63. Well defined nucleus is absent in

(A) Animal cell

(B) Plant cell

(C) Prokaryote cell

(D) Eukaryote cell

64. Which is a true fish ?

(A) Silverfish

(B) Dogfish

(C) Jellyfish

(D) Starfish

65. Nictitating in man is an example of

(A) Vestigeal organ

(B) Homologous organ

(C) Analogous organ

(D) Secretory organ

66. Which of the following diseases is transmitted by mosquito ?

(A) Pneumonia

(B) Dengue

(C) Influenza

(D) Typhoid

67. Breakdown of pyruvate using oxygen takes place in

(A) ribosome

(B) mitochondria

(C) nucleus

(D) lysosome

68. The transfer of pollen grains from anther of a flower to stigma is termed as

(A) fertilization

(B) pollination

(C) double fertilization

(D) parthenogenesis

69. The technical term given to the fertilized egg is

(A) Placenta

(B) Zygote

(C) Morula

(D) Blastocyst

70. Which chamber of human heart pumps oxygenated blood to the different parts of the body ?

(A) Left auricle

(B) Right auricle

(C) Left ventricle

(D) Right ventricle

71. The rings of cartilage surrounding the trachea help

(A) increase the surface area for exchange of gases

(B) warm the inspired air to bring it at the body temperature

(C) prevent the trachea (air tube) from collapsing

(D) prevent the dust particles and foreign bodies entering the lungs

72. In a neuron the correct path of electrical impulse is

(A) Cell body → axon → dendrite → axonal end

(B) Dendrite → cell body → axon → axonal end

(C) Axonal end → cell body → dendrite → axon

(D) Cell body → dendrite → axon → axonal end

73. Select the correct statement

(A) Autotrophs are not capable of synthesizing their own food

(B) Autotrophs obtain their food from dead decaying organic matter

(C) Autotrophs are parasitic plants which obtain their food from hosts

(D) Autotrophs are organisms which synthesize their own food from carbon dioxide and water

74. Round Green seeded pea plant (RRyy) is crossed with wrinkled yellow seeded pea plant (rrYY). Which type of seeds would be produced in F_1 generation ?

(A) Round and green

(B) Wrinkled and green

(C) Round and yellow

(D) Wrinkled and yellow

75. Which of the following protects the inner living of stomach from the action of hydrochloric acid ?

(A) Salivary amylase

(B) Pepsin

(C) Renin

(D) Mucus