MATHEMATICS – SET 2

1. Domain of $\sqrt{a^2 - x^2}\ (a > 0)$ is

   A) $(-a, a)$ B) $[-a, a]$ C) [0, a] D) $(-a, 0]$

2. If $\left(\frac{1+i}{1-i}\right)^x = 1$, then

   A) $x = 2n + 1$ B) $x = 4n$ C) $x = 2n$ D) $x = 4n + 1$, where $n \in N$

3. The number of triangles that are formed by choosing the vertices from a set of 12 points, seven of which lie on the same line is

   A) 105 B) 15 C) 175 D) 185

4. If the line $\frac{x}{a} + \frac{y}{b} = 1$ passes through the points $(2, -3)$ and $(4, -5)$, then (a, b) is

   A) $(1, 1)$ B) $(-1, 1)$ C) $(1, -1)$ D) $(-1, -1)$

5. The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half of the distance between the foci is

   A) $\frac{4}{3}$ B) $\frac{4}{\sqrt{3}}$ C) $\frac{2}{\sqrt{3}}$ D) None of these

6. If $f(x) = 1 + x + \frac{x^2}{2} + \cdots + \frac{x^{100}}{100}$, then $f'(1)$ is equal to

   A) $\frac{1}{100}$ B) 100 C) Does not exist D) 0

7. A single letter is selected at random from the word 'PROBABILITY'. The probability that it is a vowel, is

   A) $\frac{1}{3}$ B) $\frac{4}{11}$ C) $\frac{2}{11}$ D) $\frac{3}{11}$

8. Let $A = \{1, 2, 3, \ldots n\}$ and $B = \{a, b\}$. Then the number of surjections from A into B is

   A) ${}^{n}P_2$ B) $2^n - 2$ C) $2^n - 1$ D) None of these

9. If $tan^{-1}x + tan^{-1}y = \frac{4\pi}{5}$, then $cot^{-1}x + cot^{-1}y$ equals

   A) $\frac{\pi}{5}$ B) $\frac{2\pi}{5}$ C) $\frac{3\pi}{5}$ D) π

10. If A is a square matrix such that $A^2 = I$, then $(A - I)^3 + (A + I)^3 - 7A$ is equal to

    A) A B) $I - A$ C) $I + A$ D) $3A$

11. $\frac{d}{dx}\left[sin^{-1}\left(x\sqrt{1-x} - \sqrt{x}\sqrt{1-x^2}\right)\right]$ is equal to

    A) $\frac{1}{2\sqrt{x(1-x)}} - \frac{1}{\sqrt{1-x^2}}$ B) $\frac{1}{\sqrt{1-\{x\sqrt{1-x} - \sqrt{x(1-x^2)}\}^2}}$ C) $\frac{1}{\sqrt{1-x^2}} - \frac{1}{2\sqrt{x(1-x)}}$

    D) $\frac{1}{\sqrt{x(1-x)(1-x)^2}}$

12. Let $f(x) = |sinx|$. Then

A) f is everywhere differentiable

B) f is everywhere continuous but not differentiable at $x = n\pi, n \in Z$.

C) f is everywhere continuous but not differentiable at $x = (2n+1)\frac{\pi}{2}, n \in Z$.

D) None of these

13. Which of the following function is decreasing on $\left(0, \frac{\pi}{2}\right)$

A) $sin2x$ B) $tanx$ C) $cosx$ D) $cos3x$

14. $\int cos^{-1}\left(\frac{1}{x}\right) dx$ equals

A) $xsec^{-1}x + log\left|x + \sqrt{x^2-1}\right| + C$ B) $xsec^{-1}x - log\left|x + \sqrt{x^2-1}\right| + C$

C) $-xsec^{-1}x - log\left|x + \sqrt{x^2-1}\right| + C$ D) None of these

15. Evaluate $: \int_0^{\frac{\pi}{2}} \frac{1}{a^2sin^2x + b^2cos^2x}\, dx$

A) $\frac{\pi a}{4b}$ B) $\frac{\pi a}{2b}$ C) $\frac{\pi b}{4a}$ D) $\frac{\pi}{2ab}$

16. The area of the region bounded by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is

A) 20π sq. units B) $20\pi^2$sq. units C) $16\pi^2$sq. units D) 25πsq. units

17. The differential equation $y\frac{dy}{dx} + x = c$ represents

A) Family of hyperbolas B) Family of parabolas

C) Family of ellipse D) Family of circles

18. If $|\vec{a}| = 4$ and $-3 \leq \lambda \leq 2$, then the range of $|\lambda\vec{a}|$ is

A) $[0, 8]$ B) $[-12, 8]$ C) $[0, 12]$ D) $[8, 12]$

19. The sine of the angle between the straight line $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ and the plane $2x - 2y + z = 5$ is

A) $\frac{10}{6\sqrt{5}}$ B) $\frac{4}{5\sqrt{2}}$ C) $\frac{2\sqrt{3}}{5}$ D) $\frac{\sqrt{2}}{10}$

20. A and B are events such that $P(A) = 0.4, P(B) = 0.3$ and $P(A \cup B) = 0.5$. Then $P(B' \cap A)$ equals

A) $\frac{2}{3}$ B) $\frac{1}{2}$ C) $\frac{3}{10}$ D) $\frac{1}{5}$

Physics set – 2

21. A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s. If the catching process is completed in 0.1 s, the force of the blow exerted by the ball on the hand of the player is equal to

A) 3 N B) 30 N C) 300 N D) 150 N

22. If the linear momentum is increased by 50%, then kinetic energy will be increased by

A) 50% B) 100% C) 125% D) 25%

23. The moment of inertia of a flywheel having kinetic energy 360 J and angular speed of 20 rad/s is

A) 18 kg m^2 B) 1.8 kg m^2 C) 2.5 kg m^2 D) 9 kg m^2

24. The escape velocity for a body projected vertically upwards form the surface of earth is 11 km/sec. If the body is projected at an angle of 45° with the vertical, the escape velocity will be

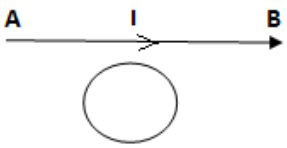
A) $\frac{11}{\sqrt{2}}$ km/sec B) $11\sqrt{2}$ km/sec C) 2 km/sec D) 11 km/sec

25. Four wires of the same material are stretched by the same load. The dimensions are given below. Which of them will elongate the most?

A) Length 100 cm, diameter 1 cm B) Length 200 cm, diameter 2 cm

C) Length 300 cm, diameter 3 cm D) Length 400 cm, diameter 0.5 cm

26. Current from A to B in the straight wire is decreasing. The direction of induced current in the loop, is



A) Clock-wise

B) anti-clock-wise

C) Changing

D) Nothing can be said

27. A 0.1m long conductor carrying a current of 50A is held perpendicular to a magnetic field of 1.25mT. the mechanical power required to move the conductor with a speed of 1m/sec is

A) 62.5mW B)625mW C)6.25mW D)12.5mW

28. Two point charges are 3 m apart their combined charge is 8μc. The force between them is 0.012 N. Charges are

A) 4μc , 4μc B) 6μc, 2μc C)5μc,3μc D) 7μc, 1μc

29. The total electric flux through a cube when a charge 8 q is placed at one corner of the cube is

A) $\frac{q}{8\epsilon_0}$ B) $\frac{\varepsilon_0}{q}$ C) $\frac{8q}{\epsilon_0}$ D) $\frac{q}{\epsilon_0}$

30. Four metallic plates each having area A are placed as shown with the distance between the consecutive plates d. The effective capacity between M and N is

A. $\frac{2\varepsilon_0 A}{d}$ B. $\frac{3}{2}\frac{\varepsilon_0 A}{d}$

C. $\frac{3\varepsilon_0 A}{d}$ D. $\frac{4\varepsilon_0 A}{d}$

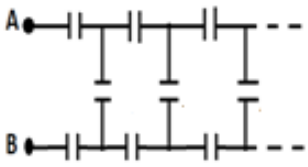
31. The equivalent capacitance of the infinite ladder shown in the following diagram between A and B (each capacitor is of capacitance equal to 1μF) is

A) 1μF

B) 1.5mF

C) 0.366μF

D) 1.366μF



32. The charge of $\frac{10}{3}$nC are placed at each of the four corners of square of side 8cm. The potential at the intersection of the diagonals is

A. $150\sqrt{2}$ B) $900\sqrt{2}$ C) $1500\sqrt{2}$ D) 900V

33. Charges 2q, q and q are placed at the corners A, B and C of an equilateral triangle ABC. If E is the electric field at the circum centre O of the triangle , due to the charge q , then the magnitude and direction of the resultant electric field at O is

A) E along AO B) 2E along AO C) E along BO D) E along CO

34. Two wires made of same material have their electrical resistances in the ratio 1:4. If their lengths are in the ratio 1:2, the ratio of their masses is

A. 1:1 B.1:8 C.8:1 D. 2:1

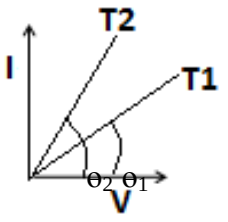
35. I – V curves are shown for a metallic conductor at two different temperatures T_1 and T_2 in the figure. The correct relation between T_1 and T_2 is

A. $T_1 > T_2$

B. $T_1 < T_2$

C. $T_1 = T_2$

D. None of these



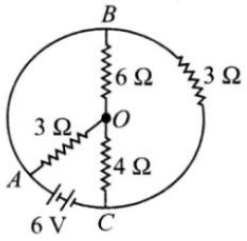
36. In the circuit shown in figure the total current supplied by the battery is

A. 1 A

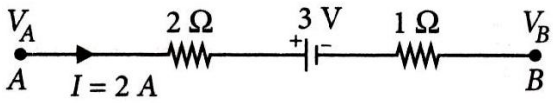
B. 2 A

C. 3 A

D. 6 A



37. The potential difference $(V_A - V_B)$ between the points A and B in the given figure is



A. -3 V B. $+3$ V C.$+6$ V D. $+9$ V

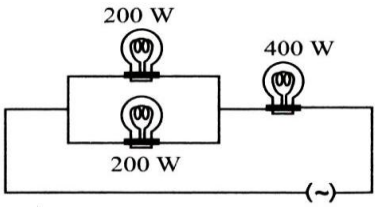
38. Three electric bulbs of 200 W, 200 W and 400 W are shown in figure. The resultant power of the combination is

A. 800 W

B. 400 W

C. 200 W

D. 600 W



39. The instantaneous magnitudes of the electric field (E) and the magnetic field (B) vectors in an electromagnetic wave propagating in vacuum are related as

A) $E = \frac{B}{c}$ B) $E = cB$ C) $E = \frac{B}{c^2}$ D) $E = c^2B$

40. The FM Radio broad casting band is

A. 5 MHz to 30 MHz B) 88 MHz to 108 MHz

C. 30 KHz to 300 KHz D) 3 GHz to 30 GHz

Set – 2 (chemistry)

41. A sample of gas has a volume of 0.2 litre measured at 1 atm pressure and 0°C . At the same pressure, the volume of a gas at 273°C

A) 0.1 litre B) 0.4 litre C) 0.8litre D) 0.6 litre

42. If a system absorbs 600 J of heat and performs 350J of work, the increase in the internal energy of the system is

A. 850J B. 350J C. 250J D. 600J

43. C (diamond) + $O_2 \rightarrow CO_2$ (g) ; $\Delta H = -94.5$ k .cal

C (graphite) + $O_2 \rightarrow CO_2$ (g) ; $\Delta H = -94.05$k .cal

What is the ΔH value for the reaction, C (graphite) → C (diamond) in kCal ?

A) – 0.45 B) +0.45 C) +188.55 D) 188.55

44. For the reaction CO (g) + ½ O_2 (g) ⇌ **CO_2**(g) Kp/Kc = ?

A) 1 B) RT C) $\frac{1}{\sqrt{RT}}$ D) $(RT)^{1/2}$

45. How much water should be added to 10 ml of 0.05 M H_2SO_4 to increase its pH by 2 units?

A) 90ml B) 99 ml C) 2000ml D) 990 ml

46. Physical adsorption

A) involves the weak attractive interaction between the adsorbent and adsorbate

B) involves the chemical interaction between the adsorbent and adsorbate

C) is irreversible in nature

D) Increasing with increase of temperature

47. Which of the following metals is leached by cyanide process?

A) Silver B) Copper C) Sodium D) Aluminium

48. Mond's process is used for extraction of

A) Nickel B) Silver C) copper D) Gold

49. Which of the following is tribasic acid?

A) H_3PO_3 B) H_3PO_2 C) H_3PO_4 D) $H_4P_2O_7$

50. Which of the following is thermally most stable?

A) H_2S B) H_2O C) H_2Se D) $H_4P_2O_3$

51. The shape of ClO_4^- ion is

A) Triangular pyramid B) Tetrahedral

C) Triangular planar D) Triangular bipyramidal

52. Which of the following shows only negative oxidation state in compounds?

A) Chloride B) bromide C) iodine D) fluorine

53. Which shows the maximum magnetic moment?

A) V^{3+} B) Cr^{3+} C)Fe^{3+} D) Co^{2+}

54. When SO_2 is passed through acidified $K_2Cr_2O_7$ solution

A) the solution becomes blue B) the solution is decolourised

C) SO_2 is reduced D) green $Cr_2(SO_4)_3$ is formed

55. Identify the cationic complex

A) $[Fe(CO)_5]$ B) $[Ni(CO)_4]$ C) $[Cu(NH_3)_4]SO_4$ D) $K_4[Fe(CN)_6]$

56. Specific conductance of 0.1M sodium chloride solution is$1.06 \times 10^{-2} ohm^{-1}cm^{-1}$. It's molar Conductance in $ohm^{-1}cm^2mol^{-1}$ is

A) 1.06×10^2 B) 1.06×10^3 C)1.06×10^4 D) 5.3×10^2

57. When 9.65 coulombs of electricity is passed through a solution of silver nitrate (at . mass of Ag = 108) the amount of silver deposited is

A) 10.8mg B) 5.4mg C) 16.2 mg D) 21.2mg

58. The unit of rate constant for a zero order reaction is

A) $Litre\ sec^{-1}$ B) $Litre\ mol^{-1}sec^{-1}$ C) $mol\ litre^{-1}sec^{-1}$ D) $molsec^{-1}$

59. For a chemical reaction $A \rightarrow B$ it is found that the rate of reaction doubles, when the concentration of A is increased four times. The order of a reaction is

A) 2 B) 1 C) ½ D) 0

60. Which of the following molecules is linear?

A) H_2O B) NH_3 C) C_2H_2 D) CH_4