

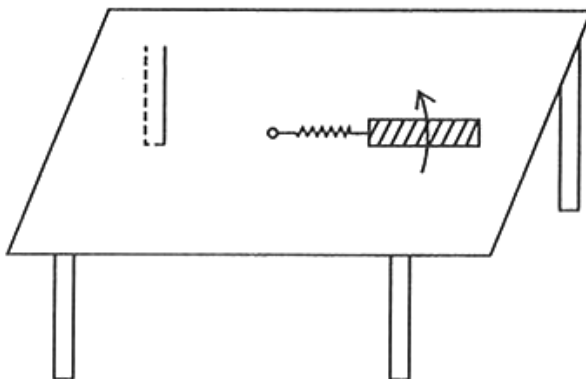
PART- A : PHYSICS

Q.1 A uniform cylinder of length L and mass M having cross - sectional area A is suspended, with its length vertical, from a fixed point by a massless spring, such that it is half submerged in a liquid of density σ at equilibrium position. The extension x_0 of the spring when it is in equilibrium is

- a. Mg/K
- b. $Mg/k(1- LA\sigma/2M)$
- c. $Mg/k(1- LA\sigma/2M)$
- d. $Mg/k(1+ LA\sigma/M)$

Answer:3

Q.2 A metallic rod of length ' A ' is tied to a string of length $2A$ and made to rotate with angular speed ω on a horizontal table with one end of the string fixed. If there is a vertical magnetic field ' B ' in the region, the e.m.f. induced across the ends of the rod is :



- a. $2B \omega A^2/2$
- b. $3B \omega A^2/2$
- c. $4B \omega A^2/2$
- d. $5B \omega A^2/2$

Answer:4

Q.3 This question has statement I and Statement II. Of the four choice given after the statements, choose the one that best describes the two statements.

Questions and Solutions.

Statement – I : A Point particle of mass m moving with speed v collides with stationary point particle of mass M . If the maximum energy loss possible is given as $F(1/2 mv^2)$ then $f = (m/M+m)$

Statement – II : Maximum energy loss occurs when the particles get stuck together as a result of the collision.

- a. Statement - I is true, Statement - II is true, statement - II is a correct explanation of Statement – I
- b. Statement - I is true, Statement - II is true, statement - II is not a correct explanation of Statement – I
- c. Statement - I is true, Statement - II is false
- d. Statement – I is false, Statement – II is true

Answer:4

Q.4 Let $[\epsilon_0]$ denote the dimensional formula of the permittivity of vacuum. If M = mass, L = length, T = Time and A = electric current, then :

- a. $[\epsilon_0] = [M^{-1} L^{-3} T^2 A]$
- b. $[\epsilon_0] = [M^{-1} L^{-3} T^4 A^2]$
- c. $[\epsilon_0] = [M^{-1} L^2 T^{-1} A^{-2}]$
- d. $[\epsilon_0] = [M^{-1} L^2 T^{-1} A]$

Answer:2

Q.5 The amplitude of a damped oscillator decreases to 0.9 times its original magnitude in 5s. In another 10s it will decrease to α times its original magnitude, where α equals :

- a. 0.7
- b. 0.81
- c. 0.729
- d. 0.6

Answer:3

Q.6 Two capacitors C_1 and C_2 are charged to 120 V and 200 V respectively. It is found that by connecting them together the potential on each one can be made zero. Then :

- a. $5C_1 = 3C_2$
- b. $3C_1 = 5C_2$
- c. $3C_1 + 5C_2 = 0$
- d. $9C_1 = 4C_2$

Answer:2

Q.7 A sonometer wire of length 1.5 m is made of steel. The tension in it produce an elastic strain of 1%. What is the fundamental frequency of steel if density and elasticity of steel are $7.7 \times 10^3 \text{ kg / m}^3$ and $2.2 \times 10^{11} \text{ N/m}^2$ respectively ?

- a. 188.5 Hz
- b. 178.2 Hz
- c. 200.5 Hz
- d. 770 Hz

Answer:2

Q.8 A circular loop of radius 0.3 cm lies parallel to a much bigger circular loop of radius 20 cm. The centre of the small loop is on the axis of the bigger loop. The distance between their centres is 15 cm. If a current of 2.0 A flows through the smaller loop, then the flux linked with bigger loop is:

- a. $9.1 \times 10^{-11} \text{ weber}$
- b. $6 \times 10^{-11} \text{ weber}$
- c. $3.3 \times 10^{-11} \text{ weber}$
- d. $6.6 \times 10^{-9} \text{ weber}$

Answer:1

Q.9 Diameter of a plano - convex lens is 6 cm and thickness at the centre is 3 mm. If speed of light in material of lens is 2×10^8 m/s, the focal length of the lens is

- a. 15 cm
- b. 20 cm
- c. 30 cm
- d. 10 cm

Answer:3

Q.10. What is the minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of $2R$?

- a. $5GmM/6R$
- b. $2GmM/3R$
- c. $GmM/2R$
- d. $GmM/3R$

Answer:1

Q.11A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 pico farad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it.

- a. 10.62 MHz
- b. 10.62 kHz
- c. 5.31 MHz
- d. 5.31 kHz

Answer:4

Q.12A beam of unpolarised light of intensity I_0 is passed through a polaroid A and then through another polaroid B which is oriented so that its principal plane makes an angle of 45° relative to that of A. The intensity of the emergent light is :

- a. I_0

b. $I_0/2$

c. $I_0/4$

d. $I_0/8$

Answer:3

Q.13 The supply voltage to a room is 120 V. The resistance of the lead wires is 6Ω . A 60 W bulb is already switched on. What is the decrease of voltage across the bulb, when a 240 W heater is switched on in parallel to the bulb ?

a. zero Volt

b. 2.9 Volt

c. 13.3 Volt

d. 10.04 Volt

Answer:3

Q.14 A hoop of radius r and mass m rotating with an angular velocity ω_0 is placed on a rough horizontal surface. The initial velocity of the centre of the hoop is zero. What will be the velocity of the centre of the hoop when it ceases to slip ?

a. $r\omega_0/4$

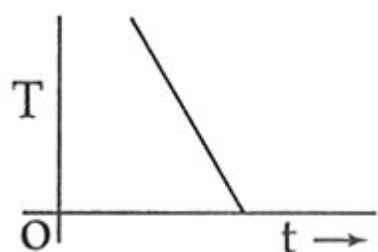
b. $r\omega_0/3$

c. $r\omega_0/2$

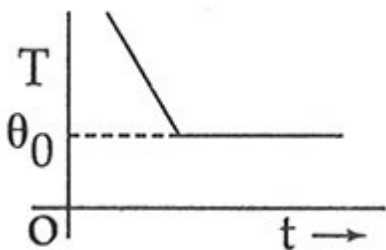
d. $r\omega_0$

Answer:3

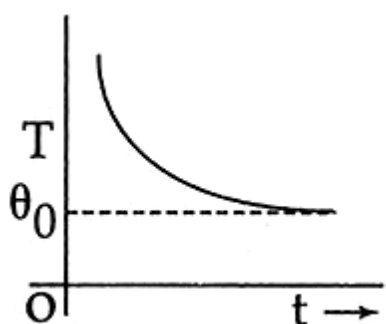
Q.15 If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0 , the graph between the temperature T of the metal and time t will be closed to :



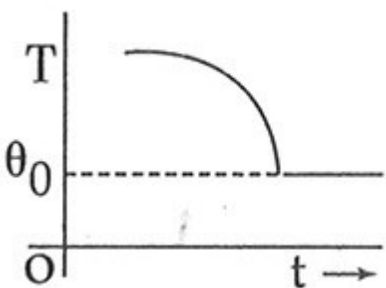
a.



b.



c.



D

Answer:3

Questions and Solutions.

Q.16 This question has statement I and Statement II. Of the four choices given after the Statements, choose the one that best describes the two statements.

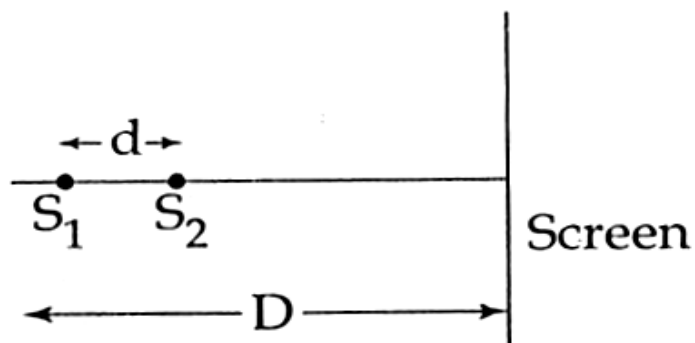
Statement – I : Higher the range, greater is the resistance of ammeter.

Statement – II : To increase the range of ammeter, additional shunt needs to be used across it.

- a. Statement - I is true, Statement - II is true, Statement - II is the correct explanation of Statement - I
- b. Statement - I is true, Statement - II is true, Statement - II is not the correct explanation of Statement - I.
- c. Statement - I is true, Statement - II is false.
- d. Statement - I is false, Statement - II is true.

Answer:4

Q.17 Two coherent point sources S_1 and S_2 are separated by a small distance 'd' as shown. The fringes obtained on the screen will be :



- a. points
- b. straight lines
- c. semi-circles
- d. concentric circles

Answer:4

Q.18 The magnetic field in a travelling electromagnetic wave has a peak value of 20 nT. The peak value of electric field strength is :

- a. 3v/m

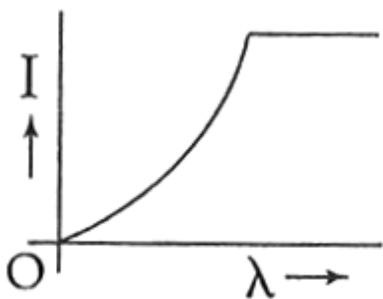
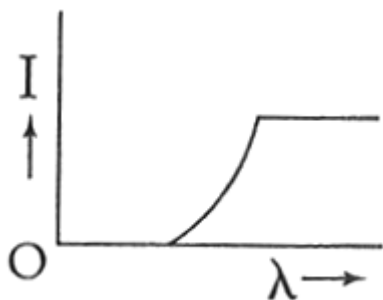
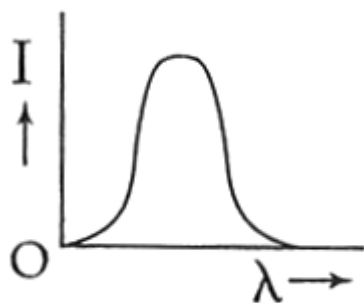
b. 6V/m

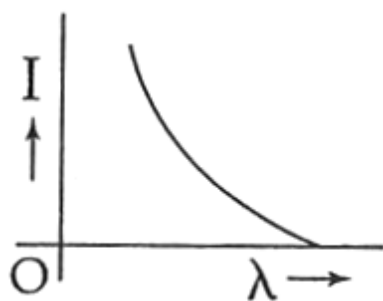
c. 9V/m

d. 12V/m

Answer:2

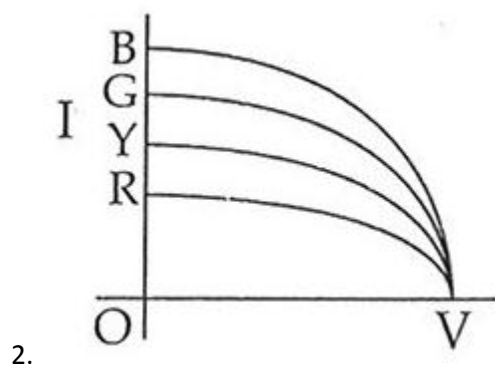
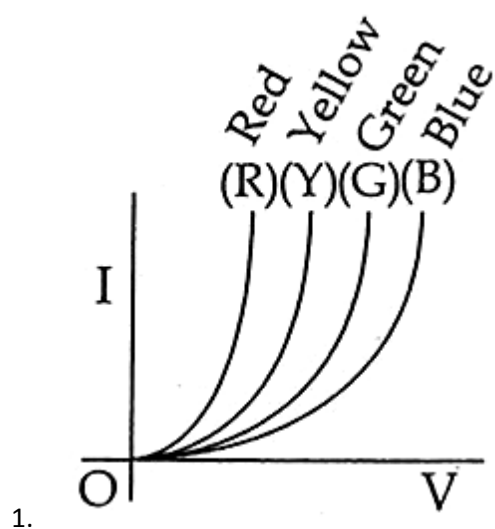
Q.19 The anode voltage of a photocell is kept fixed. The wavelength λ of the light falling on the cathode is gradually changed. The plate current I of the photocell varies as follows :

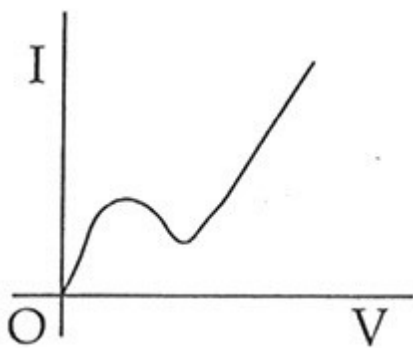




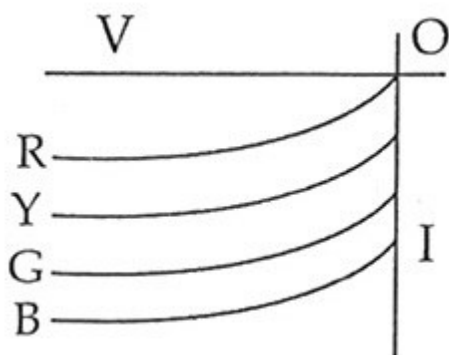
Answer:4

Q.20 The I – V characteristic of an LED is :





3.



4.

Answer:1

Q.21 Assume that a drop of liquid evaporates by decrease in its surface energy. So that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible? The surface tension is T , density of liquid is ρ and L is its latent heat of vaporization.

- a. $\rho l/T$
- b. $\sqrt{T/\rho L}$
- c. $T/\rho L$
- d. $2T/\rho L$

Answer4

Q.22 In a hydrogen like atom electron makes transition from an energy level with quantum number n to another with quantum number $(n - 1)$. If $n \gg 1$, the frequency of radiation emitted is proportional to :

- a. $1/n$

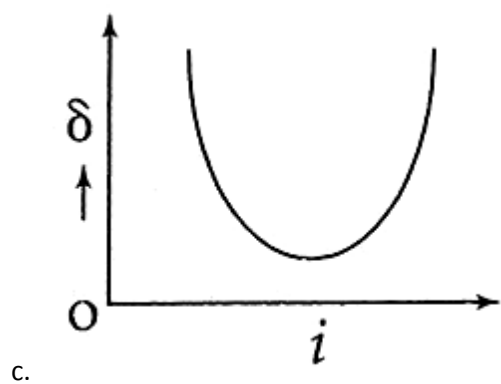
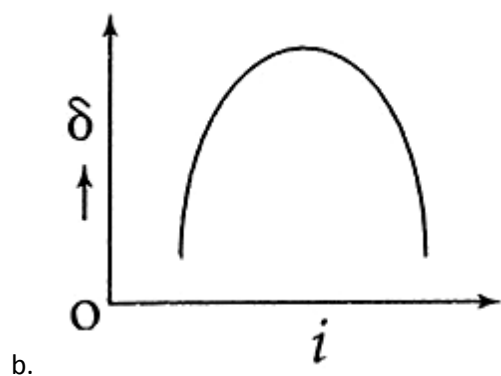
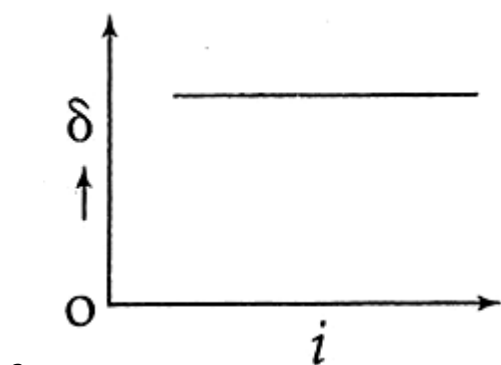
b. $1/n^2$

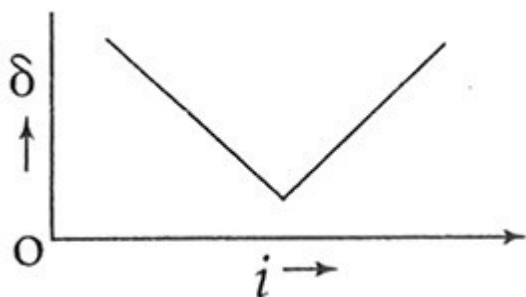
c. $1/n^{3/2}$

d. $1/n^3$

Answer:4

Q.23 graph between angle of deviation (δ) and angle of incidence (i) for a triangular prism is represented by :





d.

Answer:3

Q.24 Two charges, each equal to q , are kept at $x = -a$ and $x = a$ on the x -axis. A particle of mass m and charge $q_0 = q/2$ is placed at the origin. If charge q_0 is given a small displacement ($y \ll a$) along the y -axis, the net force acting on the particle is proportional to :

- a. y
- b. $-y$
- c. $1/y$
- d. $-1/y$

Answer:

Q.25 Two short bar magnets of length 1 cm each have magnetic moments 1.20 Am^2 and 1.00 Am^2 respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the South. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultant horizontal magnetic induction at the mid - point O of the line joining their centre is close to

(Horizontal component of earth's magnetic induction is $3.6 \times 10^{-5} \text{ Wb / m}^2$)

- $3.6 \times 10^{-5} \text{ Wb/m}^2$
- $2.56 \times 10^{-4} \text{ Wb/m}^2$
- $3.50 \times 10^{-4} \text{ Wb/m}^2$
- $5.80 \times 10^{-4} \text{ Wb/m}^2$

Answer:2

PART- B : CHEMISTRY

Q.26 Which of the following complex species is not expected to exhibit optical isomerism ?

- a. $[\text{Co}(\text{en})_3]^{3+}$
- b. $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- c. $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
- d. $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^+$

Answer:3

Q.27 Which one of the following molecules is expected to exhibit diamagnetic behaviour ?

- a. C_2
- b. N_2
- c. O_2
- d. S_2

Answer:3

Q.28 A solution of (–)-1 – chloro – 1 – phenylethane in toluene racemises slowly in the presence of a small amount of SbCl_5 , due to the formation of :

- a. carbanion
- b. carbene
- c. carbocation
- d. free radical

Answer:3

Q.29 A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C . As it does so, it absorbs 208 J of heat. The values of q and w for the process will be :

($R = 8.314 \text{ J / mol K}$) ($\ln 7.5 = 2.01$)

- a. $q = +208 \text{ J}$, $w = -208 \text{ J}$

Questions and Solutions.b. $q = -208 \text{ J}$, $w = -208 \text{ J}$ c. $q = -208 \text{ J}$, $w = +208 \text{ J}$ d. $q = +208 \text{ J}$, $w = +208 \text{ J}$ **Answer:1**

Q.30 The molarity of a solution obtained by mixing 750 mL of 0.5(M)HCl with 250 mL of 2(M)HCl will be :

a. 0.875 M

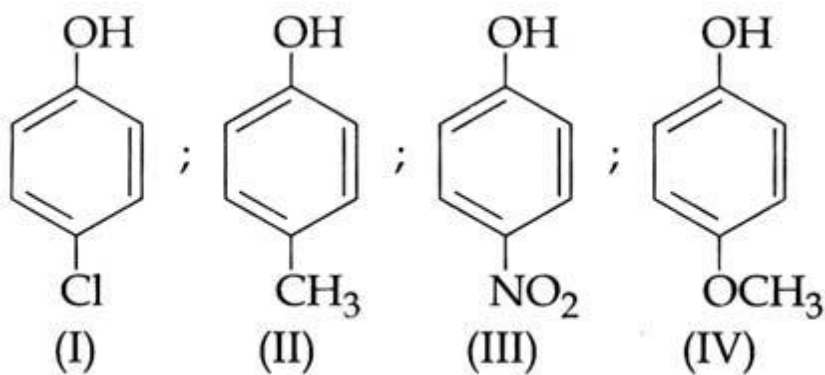
b. 1.00 M

c. 1.75 M

d. 0.975 M

Answer:1

Q.31 Arrange the following compounds in order of decreasing acidity :

a. $\text{II} > \text{IV} > \text{I} > \text{III}$ b. $\text{I} > \text{II} > \text{III} > \text{IV}$ c. $\text{III} > \text{I} > \text{II} > \text{IV}$ d. $\text{IV} > \text{III} > \text{I} > \text{II}$ **Answer:3**

Questions and Solutions.

Q.32 For a gaseous state, if most probable speed is denoted by C^* , average speed by C and mean square speed by C , then for a large number of molecules the ratios of these speeds are :

- a. $C^* : C : C = 1.225 : 1.128 : 1$
- b. $C^* : C : C = 1.128 : 1.225 : 1$
- c. $C^* : C : C = 1 : 1.128 : 1.225$
- d. $C^* : C : C = 1 : 1.225 : 1.128$

Answer:3

Q.33 The rate of a reaction doubles when its temperature changes from 300 K to 310 K. Activation of such a reaction will be :

($R = 8.314 \text{ JK}^{-1}$ and $\log 2 = 0.301$)

- a. 53.6 kJ mol^{-1}
- b. 48.6 kJ mol^{-1}
- c. 58.5 kJ mol^{-1}
- d. 60.5 kJ mol^{-1}

Answer:1

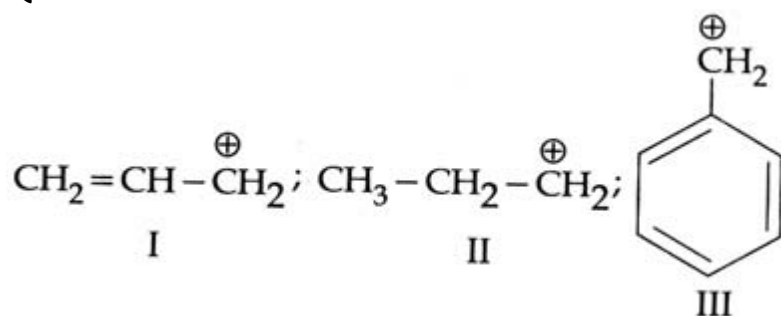
Q.34 A compound with molecular mass 180 is acylated with CH_3COCl to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is

- a. 2
- b. 5
- c. 4
- d. 6

Answer:2

Q.35 The order of stability of the following carbocations : is

Questions and Solutions.



- a. $III > II > I$
b. $II > III > I$
c. $I > II > III$
d. $III > I > II$

Answer:4

Q.36 Which of the following is the wrong statement ?

- a. ONCl and ONO^- are not isoelectronic
- b. O_3 molecule is bent
- c. Ozone is violet to black in solid state
- d. Ozone is diamagnetic gas

Answer:1

Q.37 A gaseous hydrocarbon gives upon combustion 0.72 g. of water and 3.08 g of CO₂. The empirical formula of the hydrocarbon is :

- a. C_2H_4
b. C_3H_4
c. C_6H_5
d. C_7H_8

Answer:4

Q.38 Which of the following exists as covalent crystals in the solid state ?

- a. Iodine
- b. Silicon
- c. Sulphur
- d. Phosphorus

Answer:2

Q.39 Synthesis of each molecule of glucose in photosynthesis involves :

- a. 18 molecules of ATP
- b. 10 molecules of ATP
- c. 8 molecules of ATP
- d. 6 molecules of ATP

Answer:4

Q.40 The coagulating power of electrolytes having ions Na^+ , Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order :

- a. $\text{Al}^{3+} < \text{Ba}^{2+} < \text{Na}^+$
- b. $\text{Na}^+ < \text{Ba}^{2+} < \text{Al}^{3+}$
- c. $\text{Ba}^{2+} < \text{Na}^+ < \text{Al}^{3+}$
- d. $\text{Al}^{3+} < \text{Na}^+ < \text{Ba}^{2+}$

Answer:2

Q.41 Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar ?

- a. $\text{Ca} < \text{S} < \text{Ba} < \text{Se} < \text{Ar}$
- b. $\text{S} < \text{Se} < \text{Ca} < \text{Ba} < \text{Ar}$
- c. $\text{Ba} < \text{Ca} < \text{Se} < \text{S} < \text{Ar}$

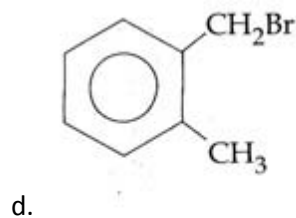
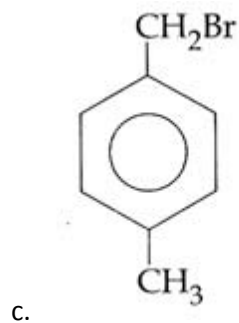
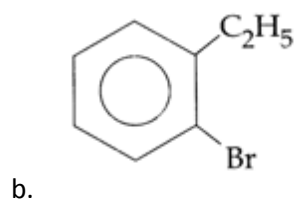
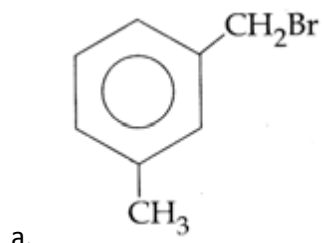
Questions and Solutions.

d. $\text{Ca} < \text{Ba} < \text{S} < \text{se} < \text{Ar}$

Answer:3

Q.42 Compound (A), $\text{C}_8\text{H}_9\text{Br}$, gives a white precipitate when warmed with alcoholic AgNO_3 .

Oxidation of (A) gives an acid (B), $\text{C}_8\text{H}_6\text{O}_4$. (B) easily forms anhydride on heating. Identify the compound (A).



Answer:4

Q.43 Four successive members of the first row transition elements are listed below with atomic numbers. Which one of them is expected to have the highest $E^\circ\text{M}$

a. Cr($Z = 24$)

b. Mn($Z = 25$)

c. Fe($Z = 26$)

d. Co($Z = 27$)

Answer:4

Q.44 How many litres of water must be added to 1 litre of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2 ?

a. 0.1 L

b. 0.9 L

c. 2.0 L

d. 9.0 L

Answer:4

Q.45 The first ionisation potential of Na is 5.1 eV. The value of electron gain enthalpy of Na^+ will be :

a. -2.55 eV

b. -5.1 eV

c. -10.2 eV

d. +2.55 eV

Answer:2

Q.46 An organic compound A upon reacting with NH_3 gives B. On heating, B gives C. C in presence of KOH reacts with Br_2 to give $\text{CH}_3\text{CH}_2\text{NH}_2$. A is :

a. CH_3COOH

b. $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

c. $\text{CH}_3\text{CH}_2\text{COOH}$

d. $\text{CH}_3\text{-CH-COOH}$

Answer:4

Q.47 An unknown alcohol is treated with the “Lucas reagent” to determine whether the alcohol is primary, secondary or tertiary. Which alcohol reacts fastest and by what mechanism :

- a. secondary alcohol by S_N1
- b. tertiary alcohol by S_N1
- c. secondary alcohol by S_N2
- d. tertiary alcohol by S_N2

Answer:2

Q.48 The gas leaked from a storage tank of the Union Carbide plant in Bhopal gas tragedy was :

- a. Methylisocyanate
- b. Methylamine
- c. Ammonia
- d. Phosgene

Answer:1

Q.49 Experimentally it was found that a metal oxide has formula $MO_{0.98}$. Metal M, is present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be :

- a. 7.01 %
- b. 4.08 %
- c. 6.05 %
- d. 5.08 %

Answer:2

PART- C : MATHEMATICS

Q.50 Distance between two parallel planes $2x + y + 2z = 8$ and $4x + 2y + 4z + 5 = 0$ is :

- 1. $3/2$

2. $5/2$

3. $7/2$

4. $9/2$

Answer:3

Q.51 At present, a firm is manufacturing 2000 items. It is estimated that the rate of change of production P w.r.t. additional number of workers x is given by $dp/dx = 100 - 12\sqrt{x}$. If the firm employs 25 more workers, then the new level of production of items is :

- a. 2500
- b. 3000
- c. 3500
- d. 4500

Answer:3

Q.52 Let A and B be two sets containing 2 elements and 4 elements respectively. The number of subsets of $A \times B$ having 3 or more elements is :

- a. 256
- b. 220
- c. 219
- d. 211

Answer:3

Q.53 The real number k for which the equation, $2x^3 + 3x + k = 0$ has two distinct real roots in $[0, 1]$

- a. lies between 1 and 2
- b. lies between 2 and 3
- c. lies between -1 and 0
- d. does not exist

Answer:4

Q.54 A ray of light along $x + \sqrt{3}y = \sqrt{3}$ gets reflected upon reaching x-axis, the equation of the reflected ray is :

- a. $y = x + \sqrt{3}$
- b. $\sqrt{3}y = x - \sqrt{3}$
- c. $y = \sqrt{3}x - \sqrt{3}$
- d. $\sqrt{3}y = x - 1$

Answer: 2

Q.55 If the equations $x^2 + 2x + 3 = 0$ and $ax^2 + bx + c = 0$, $a, b, c \in \mathbb{R}$, have a common root, then $a : b : c$ is

- a. $1 : 2 : 3$
- b. $3 : 2 : 1$
- c. $1 : 3 : 2$
- d. $3 : 1 : 2$

Answer:1

Q.56 The circle passing through $(1, -2)$ and touching the axis of x at $(3, 0)$ also passes through the point

- a. $(-5, 2)$
- b. $(2, -5)$
- c. $(5, -2)$
- d. $(-2, 5)$

Answer:3

Q.57 If x, y, z are in A.P. and $\tan^{-1} x, \tan^{-1} y$ and $\tan^{-1} z$ are also in A.P., then :

- a. $x = y = z$
- b. $2x = 3y = 6z$
- c. $6x = 3y = 2z$
- d. $6x = 4y = 3z$

Answer:1

Q.58 The equation of the circle passing through the foci of the ellipse $x^2/16 + y^2/9 = 1$, and having centre at (0, 3) is :

a. $x^2 + y^2 - 6y - 7 = 0$

b. $x^2 + y^2 - 6y + 7 = 0$

c. $x^2 + y^2 - 6y - 5 = 0$

d. $x^2 + y^2 - 6y + 5 = 0$

Answer:1

Q.59 A multiple choice examination has 5 questions. Each question has three alternative answers of which exactly one is correct. The probability that a student will get 4 or more correct answers just by guessing is :

a. $17/3^5$

b. $13/3^5$

c. $11/3^5$

d. $10/3^5$

Answer:3

Q.60 The x-coordinate of the incentre of the triangle that has the coordinates of mid points of its sides as (0, 1) (1, 1) and (1, 0) is :

a. $2 + \sqrt{2}$

b. $2 - \sqrt{2}$

c. $1 + \sqrt{2}$

d. $1 - \sqrt{2}$

Answer:2

Q.61 The area (in square units) bounded by the curves $y = \sqrt{x}$, $2y - x + 3 = 0$, x-axis, and lying in the first quadrant is :

a. 9

b. 36

c. 18

d. 27/4

Answer:1

Q.62 Let T_n be the number of all possible triangles formed by joining vertices of a n -sided regular polygon. If $T_{n+1} - T_n = 1$ then the value of n is

a. 7

b. 5

c.10

d. 8

Answer:2

Q.63 If z is a complex number of unit modulus and argument θ , then $\arg (1 + z/1 + z)$ equals :

a. $-\theta$

b. $\pi/2 - \theta$

c. θ

d. $\pi - \theta$

Answer:3

Q.64 If $y = (\tan^{-1} x)$ then dy/dx at $x = 1$ is equal to :

a. $1/\sqrt{2}$

b. $\frac{1}{2}$

c. 1

d. $\sqrt{2}$

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Questions and Solutions.



Answer:1

Q.65 All the students of a class performed poorly in Mathematics. The teacher decided to give grace marks of 10 to each of the students. Which of the following statistical measures will not change even after the grace marks were given ?

- a. mean
- b. median
- c. mode
- d. variance

Answer:4

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