

BITSAT Solved Paper 2018

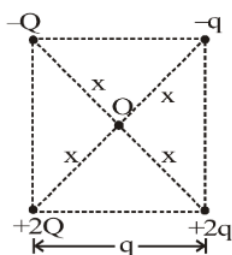
1. Four point charges $-Q, -q, 2q$ and $2Q$ are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is :

- (A) $Q = q$
 (B) $Q = \frac{1}{q}$
 (C) $Q = -q$
 (D) $Q = -\frac{1}{q}$

NEET 2012

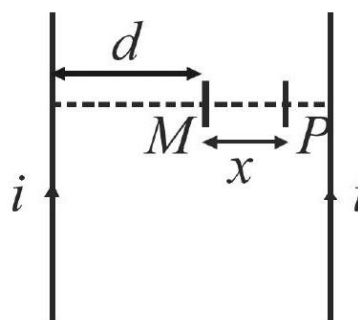
Correct Option: C**Solution:**

$$V_O = 0 \Rightarrow \frac{K(-Q)}{x} + \frac{K(-q)}{x} + \frac{K(2Q)}{x} + \frac{K(2q)}{x} = 0$$

Then $Q = -q$

2. Two long parallel wires carry equal current i flowing in the same direction and are at a distance $2d$ apart. The magnetic field B at a point lying on the perpendicular line joining the wires and at a distance x from the midpoint is -

- (A) $\frac{\mu_0 i d}{\pi(d^2 + x^2)}$
 (B) $\frac{\mu_0 i x}{\pi(d^2 - x^2)}$
 (C) $\frac{\mu_0 i x}{(d^2 + x^2)}$
 (D) $\frac{\mu_0 i d}{(d^2 + x^2)}$

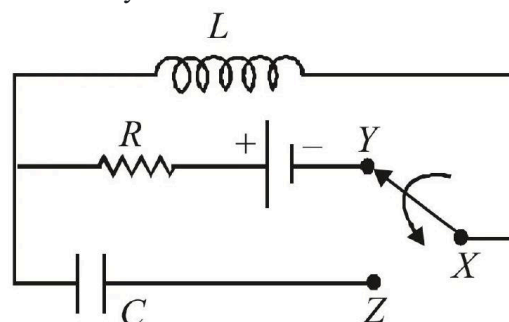
Correct Option: B**Solution:**The magnetic field due to two wires at point P is given by:

$$B_1 = \frac{\mu_0 i}{2\pi(d+x)} ; B_2 = \frac{\mu_0 i}{2\pi(d-x)}$$

Both the magnetic fields act in opposite directions.

$$\begin{aligned} \therefore B &= B_2 - B_1 = \frac{\mu_0 i}{2\pi} \left[\frac{1}{d-x} - \frac{1}{d+x} \right] \\ &= \frac{\mu_0 i}{2\pi} \left[\frac{d+x-d+x}{d^2-x^2} \right] = \frac{\mu_0 i x}{\pi(d^2-x^2)} \end{aligned}$$

3. In the circuit shown, the symbols have their usual meanings. The cell has emf E . X is initially joined to Y long time. Then, X is joined to Z . The maximum charge on C at any later time will be



- (A) $\frac{E}{R\sqrt{LC}}$ (B) $\frac{ER}{2\sqrt{LC}}$
 (C) $\frac{E\sqrt{LC}}{2R}$ (D) $\frac{E\sqrt{LC}}{R}$

Correct Option: D**Solution:**

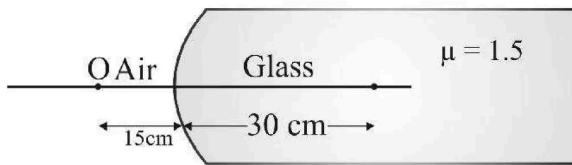
$$\text{Current in inductor} = \frac{E}{R}$$

$$\therefore \text{its energy} = \frac{1}{2} \frac{LE^2}{R^2}$$

Same energy is later stored in capacitor:

$$\frac{Q^2}{2C} = \frac{1}{2} \frac{LE^2}{R^2} \Rightarrow Q = \sqrt{LC} \frac{E}{R}$$

4. A point object O is placed in front of a glass rod having a spherical end of radius of curvature 30 cm. The image would be formed at



- (A) 30 cm left (B) infinity
(C) 1 cm to the right (D) 18 cm to the left

Correct Option: A

Solution:

Using, $\frac{\mu}{v} - \frac{1}{u} = \frac{\mu-1}{R}$

or $\frac{1.5}{v} - \frac{1}{-15} = \frac{1.5-1}{+30}$

$\therefore v = -30 \text{ cm}$

5. In Young's double slit experiment, $\lambda = 500 \text{ nm}$, $d = 1 \text{ mm}$, $D = 1 \text{ m}$. What is the minimum distance from the central maximum for which the intensity is half of the maximum intensity?

- (A) $2.5 \times 10^{-4} \text{ m}$
(B) $1.25 \times 10^{-4} \text{ m}$
(C) $0.625 \times 10^{-4} \text{ m}$
(D) $0.3125 \times 10^{-4} \text{ m}$

Correct Option: C

Solution:

6. What is the voltage gain in a common emitter amplifier, where input resistance is 3Ω and load resistance 24Ω , $\beta = 0.6$?

- (A) 8.4 (B) 4.8 (C) 2.4 (D) 480

Correct Option: B

Solution:

Voltage gain, $A_v = \beta \frac{R_L}{R_i} = 0.6 \times \frac{24}{3} = 4.8$

7. The acceleration due to gravity on the surface of the moon is $\frac{1}{6}$ that on the surface of earth and the diameter of the moon is one-fourth that of earth. The ratio of escape velocities on earth and moon will be

- (A) $\frac{\sqrt{6}}{2}$ (B) $\sqrt{24}$
(C) 3 (D) $\frac{\sqrt{3}}{2}$

Correct Option: B

Solution:

8. Given $\vec{P} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\vec{Q} = \hat{j} - 2\hat{k}$. The magnitude of their resultant is

- (A) $\sqrt{3}$ (B) $2\sqrt{3}$ (C) $3\sqrt{3}$ (D) $4\sqrt{3}$

Correct Option: B

Solution:

$$|\vec{P} + \vec{Q}| = |2\hat{i} - 3\hat{j} + 4\hat{k} + \hat{j} - 2\hat{k}| = |2\hat{i} - 2\hat{j} + 2\hat{k}|$$

$$= \sqrt{2^2 + 2^2 + 2^2} = 2\sqrt{3}$$

9. A particle of mass m executes simple harmonic motion with amplitude a and frequency v . The average kinetic energy during its motion from the position of equilibrium to the end is

- (A) $2\pi^2 ma^2 v^2$ (B) $\pi^2 ma^2 v^2$
(C) $\frac{1}{4} ma^2 v^2$ (D) $4\pi^2 ma^2 v^2$

Correct Option: B

Solution:

The kinetic energy of a particle executing S.H.M. is given by

$$K = \frac{1}{2} ma^2 \omega^2 \sin^2 \omega t$$

Now, average K.E. $= \langle K \rangle = \langle \frac{1}{2} m \omega^2 a^2 \sin^2 \omega t \rangle$

$$= \frac{1}{2} m \omega^2 a^2 \langle \sin^2 \omega t \rangle$$

$$= \frac{1}{2} m \omega^2 a^2 \left(\frac{1}{2} \right) \quad (\because \langle \sin^2 \theta \rangle = \frac{1}{2})$$

$$= \frac{1}{4} m \omega^2 a^2 = \frac{1}{4} ma^2 (2\pi v)^2 \quad (\because \omega = 2\pi v)$$

or, $\langle K \rangle = \pi^2 ma^2 v^2$

10. The dipole moment of the given charge distribution is



- (A) $-\frac{4R}{\pi} \hat{i}$
(B) $\frac{4Rq}{\pi} \hat{i}$
(C) $-\frac{2Rq}{\pi} \hat{i}$
(D) $\frac{2Rq}{\pi} \hat{i}$

Correct Option: B

Solution:

11. At a place, if the earth's horizontal and vertical components of magnetic fields are equal, then the angle of dip will be

(A) 30° (B) 90° (C) 45° (D) 0°

Correct Option: C

Solution:

$$\tan \theta = \frac{B_V}{B_H} = 1 \quad \therefore \quad \theta = 45^\circ$$

12. The third line of Balmer series of an ion equivalent to hydrogen atom has wavelength of 108.5 nm. The ground state energy of an electron of this ion will be

(A) 3.4 eV (B) 13.6 eV
(C) 54.4 eV (D) 122.4 eV

Correct Option: C

Solution:

For third line of Balmer series $n_1 = 2, n_2 = 5$

$$\therefore \frac{1}{\lambda} = RZ^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] \text{ gives } Z^2 = \frac{n_1^2 n_2^2}{(n_2^2 - n_1^2) \lambda R}$$

On putting values $Z = 2$

$$\text{From } E = -\frac{13.6Z^2}{n^2} = \frac{-13.6(2)^2}{(1)^2} = -54.4 \text{ eV}$$

13. The binding energy per nucleon of ^{10}X is 9 MeV and that of ^{11}X is 7.5 MeV where X represents an element. The minimum energy required to remove a neutron from ^{11}X is

(A) 7.5 MeV (B) 2.5 MeV (C) 8 MeV (D) 0.5 MeV

Correct Option: B

Solution:

14. If C, the velocity of light, g the acceleration due to gravity and P the atmospheric pressure be the fundamental quantities in MKS system, then the dimensions of length will be same as that of

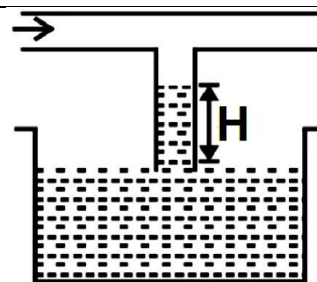
(A) $\frac{C}{g}$ (B) $\frac{C}{P}$
(C) PCg (D) $\frac{C^2}{g}$

Correct Option: D

Solution:

$$\frac{C^2}{g} = \frac{L^2 T^{-2}}{L T^{-2}} = [L]$$

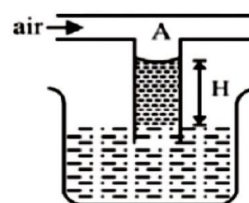
15. Figure shows a capillary rise H . If the air is blown through the horizontal tube in the direction as shown, then rise in capillary tube will become:



(A) $= H$ (B) $> H$ (C) $< H$ (D) zero

Correct Option: B

Solution:



According to Bernoulli equation,

$$P_1 + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$$

If velocity of air increases, the pressure at point (A) must decrease to maintain the equation.

According to question, air will start to blow through the horizontal tube so pressure at point (A) will decrease.

$\therefore$ The height of liquid rise in capillary tube will increase

16. A boy running on a horizontal road at 8 km/h finds the rain falling vertically. He increases his speed to 12 km/h and finds that the drops make 30° with the vertical. The speed of rain with respect to the road is

(A) $4\sqrt{7}$ km/h
(B) $9\sqrt{7}$ km/h
(C) $12\sqrt{7}$ km/h
(D) $15\sqrt{7}$ km/h

Correct Option: A

Solution:

17. A hunter aims his gun and fires a bullet directly at a monkey on a tree. At the instant the bullet leaves the barrel of the gun, the monkey drops. Pick the correct statement regarding the situation.

(A) The bullet will never hit the monkey
(B) The bullet will always hit the monkey

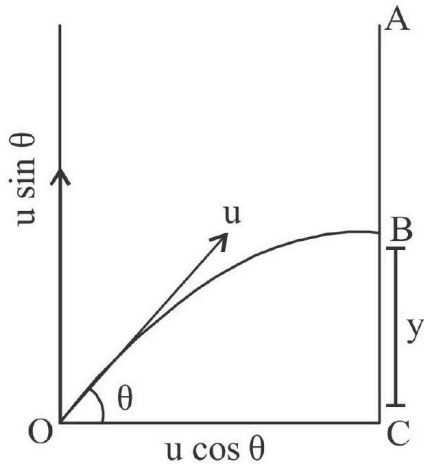
(C) The bullet may or may not hit the monkey

(D) Can't be predicted

Correct Option: B

Solution:

$$t = \frac{OC}{u \cos \theta} = \frac{x}{u \cos \theta}$$



$$AC = x \tan \theta$$

$BC =$ distance travelled by bullet in time t , vertically.

$$y = u \sin \theta t - \frac{1}{2} g t^2$$

$$AB = x \tan \theta - (u \sin \theta t - \frac{1}{2} g t^2)$$

$$= x \tan \theta - (u \sin \theta \times \frac{x}{u \cos \theta} - \frac{1}{2} g t^2)$$

$\Rightarrow$ distance travelled by monkey

$$= x \tan \theta - x \tan \theta + \frac{1}{2} g t^2 = \frac{1}{2} g t^2$$

($\therefore$ bullet will always hit the monkey)

18. A particle of mass m_1 moving with velocity v collides with a mass m_2 at rest, then they get embedded. Just after collision, velocity of the system

- (A) increases (B) decreases
(C) remains constant (D) becomes zero

Correct Option: C

Solution:

19. The ratio of the specific heats of a gas is $\frac{C_p}{C_v} = 1.66$, then the gas may be

- (A) CO_2 (B) He
(C) H_2 (D) NO_2

Correct Option: B

Solution:

Let ' n ' be the degree of freedom

$$\gamma = \frac{C_p}{C_v} = \frac{(\frac{n}{2} + 1) R}{(\frac{n}{2}) R} = (1 + \frac{2}{n}) = 1.66$$

$$= \frac{5}{3} = (1 + \frac{2}{3})$$

$\Rightarrow n = 3 \Rightarrow$ gas must be monoatomic.

20. Two oscillators are started simultaneously in same ph. After 50 oscillations of one, they get out of phase by that is half oscillation. The percentage difference of frequencies of the two oscillators is nearest to

- (A) 2% (B) 1% (C) 0.5% (D) 0.25%

Correct Option: B

Solution:

Phase change π in 50 oscillations. Phase change 2π in 100 oscillations. So frequency different ~ 1 in 100.

21. A juggler keeps on moving four balls in the air through the balls after intervals. When one ball leaves his (speed = 20 ms^{-1}) the position of other balls (height m) will be (Take $g = 10 \text{ ms}^{-2}$)

- (A) 10, 20, 10 (B) 15, 20, 15 (C) 5, 15, 20 (D) 5, 10,

Correct Option: B

Solution:

Time taken by same ball to return to the

$$\text{hands of juggler} = \frac{2u}{g} = \frac{2 \times 20}{10} = 4 \text{ s. So he is}$$

throwing the balls after each 1 s. Let at some instant he throwing ball number 4. Before 1 s of it he throws ball. height of ball 3 :

$$h_3 = 20 \times 1 - \frac{1}{2} 10(1)^2 = 15 \text{ m}$$

Before 2s, he throws ball 2. So height of ball 2 :

$$h_2 = 20 \times 2 - \frac{1}{2} 10(2)^2 = 20 \text{ m}$$

Before 3 s, he throws ball 1. So height of ball 1 :

$$h_1 = 20 \times 3 - \frac{1}{2} 10(3)^2 = 15 \text{ m}$$

22. If a stone of mass 0.05 kg is thrown out a window of a train moving at a constant speed of 100 km/h then magnitude of the net force acting on the stone is

(A) 0.5 N (B) zero (C) 50 N (D) 5 N

Correct Option: A

Solution:

(a) After the stone is thrown out of the moving train, the only force acting on it is the force of gravity i.e. its weight.

$$\therefore F = mg = 0.05 \times 10 = 0.5 \text{ N.}$$

23. A body of mass M hits normally a rigid wall with velocity V and bounces back with the same velocity. The impulse experienced by the body is

(A) MV (B) $1.5 MV$ (C) $2 MV$ (D) zero

Correct Option: C

Solution:

Impulse experienced by the body

$$= MV - (-MV) = 2MV.$$

24. A hoop rolls down an inclined plane. The fraction of its total kinetic energy that is associated with rotational motion is

(A) 1 : 2 (B) 1 : 3 (C) 1 : 4 (D) 2 : 3

Correct Option: A

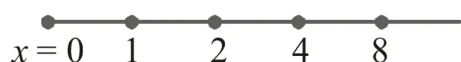
Solution:

25. Infinite number of masses, each 1 kg are placed along the x-axis at $x = \pm 1m, \pm 2m, \pm 4m, \pm 8m, \pm 16m \dots$ the magnitude of the resultant gravitational potential in terms of gravitational constant G at the origin ($x = 0$) is

(A) $\frac{G}{2}$ (B) G
(C) $2G$ (D) $4G$

Correct Option: C

Solution:



$$V = -\frac{GM}{r} = -G\left(\frac{1}{1} + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots \infty\right)$$

$$= -G\left(\frac{1}{1 - 1/2}\right) = -2G$$

26. Water of volume 2 litre in a container is heated with a coil of 1 kW at 27°C . The lid of the container is open and energy dissipates at a rate of 160 J/s. In how much time will the temperature rise from 27°C to 77°C [Given specific heat of water is $4.2 \text{ kJ/kg}^\circ\text{C}$]

(A) 8 min 20 s (B) 6 min 2 s
(C) 7 min (D) 14 min

Correct Option: A

Solution:

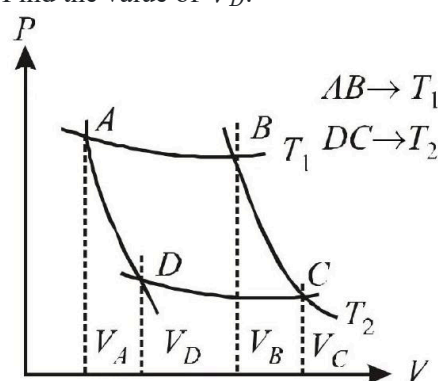
Heat gained by the water = (Heat supplied by the Coil) - (Heat dissipated to environment)

$$\Rightarrow mc\Delta\theta = P_{\text{Coil}}t - P_{\text{Loss}}t$$

$$\Rightarrow 2 \times 4.2 \times 10^3 \times (77 - 27) = 1000t - 160t$$

$$\Rightarrow t = \frac{4.2 \times 10^5}{840} = 500 \text{ s} = 8 \text{ min } 20 \text{ s}$$

27. In the following $P - V$ diagram of an ideal gas, two isobars cut two isotherms at $T_1 = 300 \text{ K}$ and $T_2 = 200 \text{ K}$. The values are $V_A = 2$ unit, $V_B = 8$ unit, $V_C = 16$ unit. Find the value of V_D .



(A) 4 unit (B) < 4 unit (C) > 5 unit (D) 5 unit

Correct Option: A

Solution:

28. The mass of H_2 molecule is $3.32 \times 10^{-24} \text{ g}$. If 10^{23} hydrogen molecules per second strike 2 cm^2 of wall at an angle of 45° with the normal, while moving with a speed of 10^5 cm/s , the pressure exerted on the wall is nearly

(A) 1350 N/m^2
(B) 2350 N/m^2
(C) 3320 N/m^2
(D) 1660 N/m^2

Correct Option: B**Solution:**

29. The wavelength of two waves are 50 and 51 cm respectively. If the temperature of the room is 20°C then what will be the number of beats produced per second by these waves, when the speed of sound at 0°C is 332 m/s ?

- (A) 24 (B) 14
(C) 10 (D) None of these

Correct Option: B**Solution:**

$$\lambda_1 = 50\text{ cm.} \quad \lambda_2 = 51\text{ cm}$$

$$v \propto \sqrt{T} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{273+20}{273}}$$

$$\Rightarrow v_2 = 319.23.$$

$$v_1 = \frac{v_2}{\lambda_1} = \frac{319.23}{0.50} = 640\text{ Hz}$$

$$v_2 = \frac{v_2}{\lambda_2} = \frac{319.23}{51 \times 10^{-2}} = 625.94 = 626\text{ Hz}$$

$$\text{No. of beats} = v_2 - v_1 = 14\text{ Hz}$$

30. The figure shows the interference pattern obtained in a double-slit experiment using light of wavelength **600 nm**. 1, 2, 3, 4 and 5 are marked on five fringes. The third order bright fringe is

- (A) 2 (B) 3 (C) 4 (D) 5

Correct Option: A**Solution:**

31. Electric potential at any point is $V = -5x + 3y + \sqrt{15}z$, then the magnitude of the electric field is -

- (A) $3\sqrt{2}$ (B) $4\sqrt{2}$ (C) $5\sqrt{2}$ (D) 7

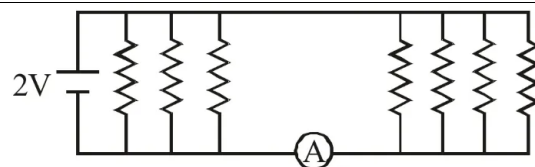
Correct Option: D**Solution:**

$$E_x = -\frac{dV}{dx} = -(-5) = 5; E_y = -\frac{dV}{dy} = -3$$

$$\text{and } E_z = -\frac{dV}{dz} = -\sqrt{15}$$

$$E_{\text{net}} = \sqrt{E_x^2 + E_y^2 + E_z^2} = \sqrt{(5)^2 + (-3)^2 + (-\sqrt{15})^2} = 7$$

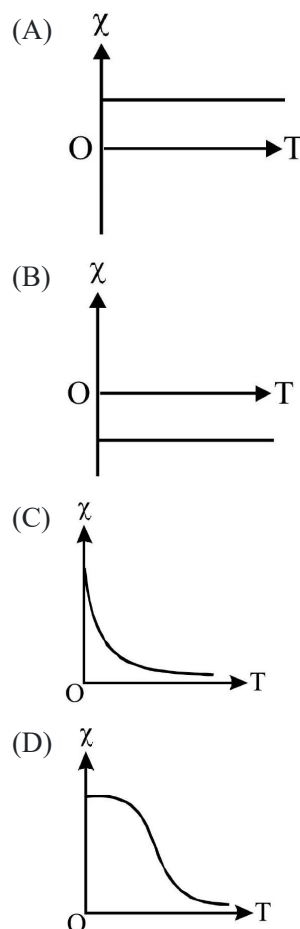
32. Seven resistances, each of value 20Ω , are connected to a 2 V battery as shown in the figure. The ammeter reading will be



- (A) $1/10\text{ A}$ (B) $3/10\text{ A}$
(C) $4/10\text{ A}$ (D) $7/10\text{ A}$

Correct Option: C**Solution:**

33. The variation of magnetic susceptibility (χ) with temperature for a diamagnetic substance is best represented

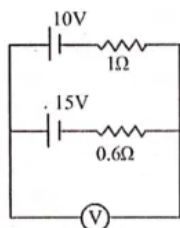
**Correct Option: B****Solution:**

34. A copper rod of length ℓ rotates about its end with angular velocity ω in uniform magnetic field B . The emf developed between the ends of the rod if the field is normal to the plane of rotation is

- (A) $B\omega\ell^2$ (B) $\frac{1}{2}B\omega\ell^2$
(C) $2B\omega\ell^2$ (D) $\frac{1}{4}B\omega\ell^2$

Correct Option: B**Solution:**

35. A 10V battery with internal resistance 1Ω and a 15V battery with internal resistance 0.6Ω are connected in parallel to a voltmeter (see figure). The reading in the voltmeter will be close to:



- (A) 12.5 V (B) 24.5 V (C) 13.1 V (D) 11.9 V

Correct Option: C

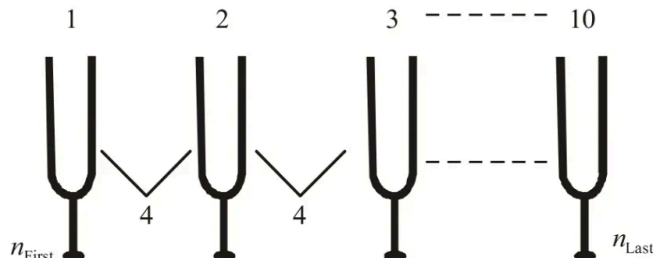
Solution:

36. 10 forks are arranged in increasing order of frequency in such a way that any two nearest tuning forks produce 4 beats/sec. The highest frequency is twice of the lowest. Possible highest and the lowest frequencies (in Hz) are

- (A) 80 and 40 (B) 100 and 50
(C) 44 and 22 (D) 72 and 36

Correct Option: D

Solution:



$$\text{Using } n_{\text{Last}} = n_{\text{First}} + (N - 1) \times x$$

where N = Number of tuning forks in series,

x = beat frequency between two successive forks

$$\Rightarrow 2n = n + (10 - 1) \times 4 \Rightarrow n = 36 \text{ Hz}$$

37. A charged particle enters in a uniform magnetic field with a certain velocity. The power delivered to the particle by the magnetic field depends on

- (A) force exerted by magnetic field and velocity of the particle.
(B) angular speed ω and radius r of the circular path.
(C) angular speed ω and acceleration of the particle.
(D) None of these

Correct Option: D

Solution:

$$\text{Power} = \frac{\text{work done}}{\text{time}}$$

As no work is done by magnetic force on the charged particle because magnetic force is perpendicular to velocity, hence power delivered is zero.

38. A resistor and an inductor are connected to an ac supply of 120 V and 50 Hz. The current in the circuit is 3 A. the power consumed in the circuit is 108 W, then the resistance in the circuit is

- (A) 12Ω (B) 40Ω
(C) $\sqrt{(52 \times 25)}\Omega$ (D) 360Ω

Correct Option: A

Solution:

In an ac circuit, a pure inductor does not consume any power. Therefore, power is consumed by the resistor only

$$\therefore P = I_v^2 R$$

$$\text{or } 108 = (3)^2 R \text{ or } R = 12\Omega$$

39. In an electron gun, the potential difference between the filament and plate is 3000 V. What will be the velocity of electron emitting from the gun?

- (A) $3 \times 10^8 \text{ m/s}$
(B) $3.18 \times 10^7 \text{ m/s}$
(C) $3.52 \times 10^7 \text{ m/s}$
(D) $3.26 \times 10^7 \text{ m/s}$

Correct Option: D

Solution:

$$\frac{1}{2}mv^2 = eV \Rightarrow v = \sqrt{\frac{2eV}{m}}$$

$$\therefore v = \sqrt{\frac{2 \times 1.6 \times 10^{-19} \times 3000}{9.1 \times 10^{-31}}} = 32.6 \times 10^6 = 3.26 \times 10^7 \text{ m/s}$$

40. A radioactive substance with decay constant of 0.5 s⁻¹ is being produced at a constant rate of 50 nuclei per sec. If there are no nuclei present initially, the time (in sec) after which 25 nuclei will be present is

- (A) 1 (B) $\ln 2$
(C) $\ln\left(\frac{4}{3}\right)$ (D) $2\ln\left(\frac{4}{3}\right)$

Correct Option: D

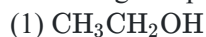
Solution:

$$\frac{dN}{dt} = 50 - \frac{N}{0.5} \quad \int_0^N \frac{dN}{50-2N} = \int_0^t dt$$

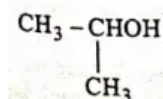
$$N = (100(1 - e^{-t/2})) = 25$$

$$t = 2 \ln(4/3)$$

41. Following compounds are given:



(3)



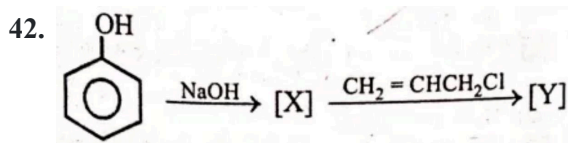
Which of the above compound(s), on being warmed with iodine solution and NaOH, will give iodoform?

(A) (1) and (2) (B) (1), (3) and (4)

(C) only (2) (D) (1), (2) and (3)

Correct Option: D

Solution:



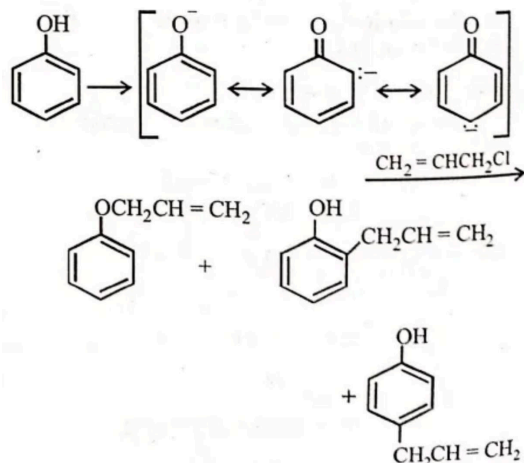
Here [Y] is a

(A) single compound (B) mixture of two compounds

(C) mixture of three compounds (D) no reaction is possible

Correct Option: C

Solution:



43. The rate constant of a reaction is 1.5×10^{-3} at 25°C and 2.1×10^{-2} at 60°C . The activation energy is

(A) $\frac{35}{333} R \log_e \frac{2.1 \times 10^{-2}}{1.5 \times 10^{-3}}$

(B) $\frac{298 \times 333}{35} R \log_e \frac{2.1}{1.5}$

(C) $\frac{298 \times 333}{35} R \log_e 2.1$

(D) $\frac{298 \times 333}{35} R \log_e \frac{2.1}{1.5}$

Correct Option: B

Solution:

44. Chloroform, CHCl_3 , boils at 61.7°C . If the K_b for chloroform is $3.63^\circ \text{C/molal}$, what is the boiling point of a solution of 15.0 kg of CHCl_3 and 0.616 kg of acenaphthylene, $\text{C}_{12}\text{H}_{10}$?

(A) 61.9 (B) 62.0 (C) 52.2 (D) 62.67

Correct Option: D

Solution:

45. Identify the incorrect statement from the following:

(A) Ozone absorbs the intense ultraviolet radiation of sun.

(B) Depletion of ozone layer is because of its chemical reactions with chlorofluoro alkanes.

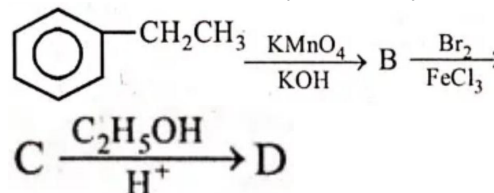
(C) Ozone absorbs infrared radiation.

(D) Oxides of nitrogen in the atmosphere can cause the depletion of ozone layer.

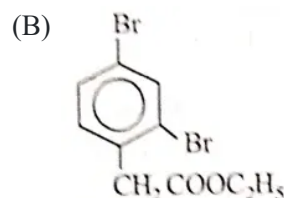
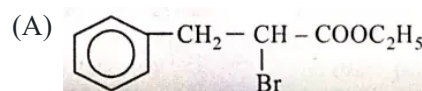
Correct Option: C

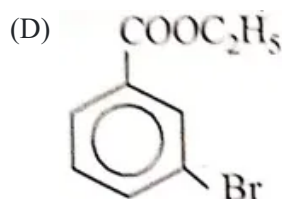
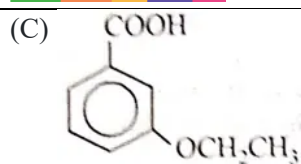
Solution:

46. In a set of reactions, ethylbenzene yielded a product I



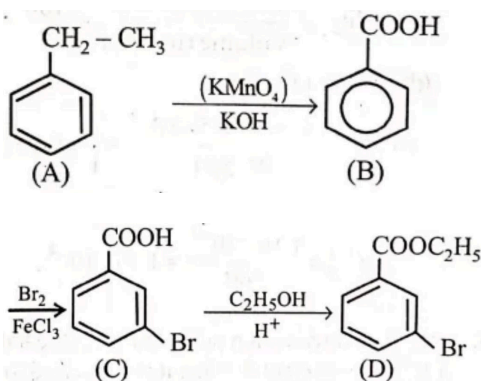
Which of the following is the product D?





Correct Option: D

Solution:



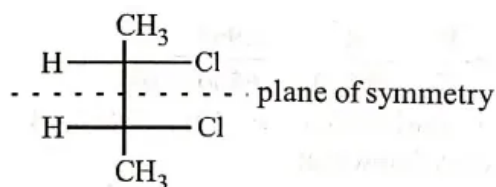
47. Which of the following will have a meso-isomer also?

- (A) 2,3-Dichloropentane (B) 2,3-Dichlorobutane
(C) 2-Chlorobutane (D) 2-Hydroxypropanoic acid

Correct Option: B

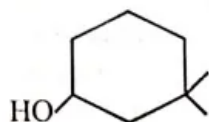
Solution:

The compound has two similar asymmetric C-atoms. It has plane of symmetry and exists in meso form.



Meso - 2,3 dichlorobutane

48. The IUPAC name of the compound is



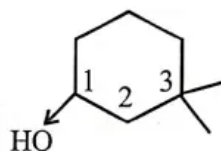
- (A) 3,3-dimethyl-1-cyclohexanol
(B) 1,1-dimethyl-3-hydroxy cyclohexane

(C) 3,3-dimethyl-1-hydroxy cyclohexane

(D) 1, 1-dimethyl-3-cyclohexanol

Correct Option: A

Solution:



IUPAC name-3,3-Dimethyl-1-cyclohexanol

49. Following are colours shown by some alkaline earth metals in flame test. Which of the following are not matched?

Metal	Colour
(i) Calcium	Apple green
(ii) Strontium	Crimson
(iii) Barium	Brick red

- (A) (i) and (iii) (B) (i) only
(C) (ii) only (D) (ii) and (iii)

Correct Option: A

Solution:

50. On passing a current of 1.0 ampere for 16 min and 5 s through one litre solution of CuCl_2 , all copper of the solution was deposited at cathode. The strength of CuC solution was (Molar mass of $\text{Cu} = 63.5$; Faraday constant = $96,500 \text{ C mol}^{-1}$)

- (A) 0.01 N (B) 0.01 M (C) 0.02 M (D) 0.2 N

Correct Option: A

Solution:

By Faraday's Ist Law, $\frac{W}{E} = \frac{q}{96500}$

(where q = it = charge of ion)

we know that no of equivalent

$$= \frac{W}{E} = \frac{it}{96500} = \frac{1 \times 965}{96500} = \frac{1}{100}$$

(where i = 1 A, t = $16 \times 60 + 5 = 965 \text{ sec.}$)

Since, we know that

$$\text{Normality} = \frac{\text{no. of equivalent}}{\text{Volume (in litre)}} = \frac{\frac{1}{100}}{1} = 0.01 \text{ N}$$

51. Pick out the wrong statement.

- (A) Nitrogen has the ability to form $p\pi - p\pi$ bonds with itself.
- (B) Bismuth forms metallic bonds in elemental state.
- (C) Catenation tendency is higher in nitrogen when compared with other elements of the same group.
- (D) Nitrogen has higher first ionisation enthalpy when compared with other elements of the same group.

Correct Option: C

Solution:

52. The blue colour of snail is due to presence of
- (A) Albumin (B) Haemocyanin
- (C) Globulins (D) Fibrinogen

Correct Option: B

Solution:

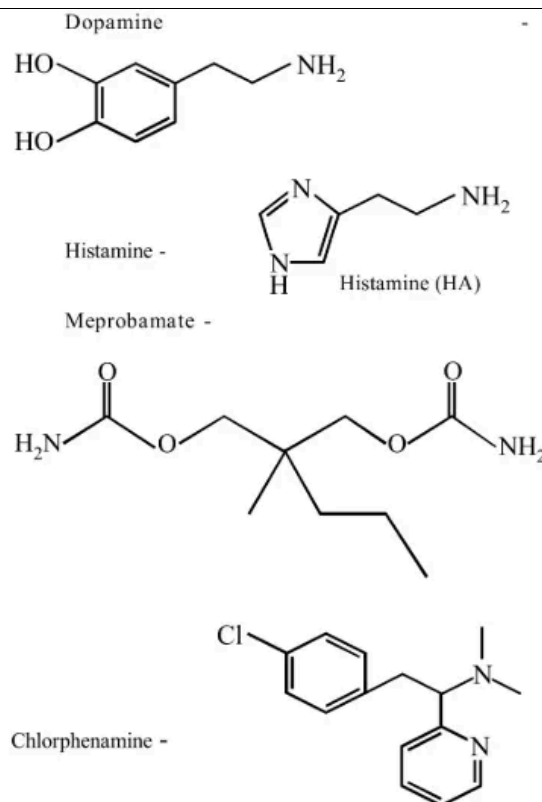
Most snail blood is blueish in color. This is because their blood cells use haemocyanin, which gets its blue color from the copper that is part of its structure.

53. Which of the following is a diamine?
- (A) Dopamine (B) Histamine
- (C) Meprobamate (D) Chlorphenamine

Correct Option: C

Solution:

diamines are those compounds which contain two amino groups.



54. Thirty percent of the bases in a sample of DNA extracted from eukaryotic cells is adenine. What percentage of thymine is present in this DNA?
- (A) 10% (B) 20% (C) 30% (D) 40%

Correct Option: B

Solution:

If 30 percent of DNA is adenine, then by Chargaff's rule percent will be thymine. The remaining 40 percent of the DNA is cytosine and guanine. Since the ratio of cytosine to guanine must be equal, then each accounts for 20 percent of the bases.

55. Arrange the following alcohols in increasing order of their reactivity towards the reaction with HCl.
 $(\text{CH}_3)_2\text{CH} - \text{OH}$ (1), $(\text{CH}_3)_3\text{C} - \text{OH}$ (2), $(\text{C}_6\text{H}_5)_3\text{COH}$ (3)
- (A) $1 < 2 < 3$ (B) $2 < 1 < 3$ (C) $3 < 1 < 2$ (D) $2 < 3 < 1$

Correct Option: A

Solution:

Alkyl halide formation in the reaction of alcohol with HX undergoes $\text{S}_{\text{N}}1$ reaction in which formation of the carbocation as intermediate occurs. Stability of carbocation is greatest for $(\text{C}_6\text{H}_5)_3\text{C}^+$ due to resonance effect, and stability of tertiary carbocation is greater than the

secondary carbocation hence the option (a) shows the correct order.

56. When an aqueous solution of copper (II) sulphate is saturated with ammonia, the blue compound crystallises on evaporation. The formula of this blue compound is:

- (A) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$ (square planar)
 (B) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ (Tetrahedral)
 (C) $[\text{Cu}(\text{NH}_3)_6]\text{SO}_4$ (Octahedral)
 (D) $[\text{Cu}(\text{SO}_4)(\text{NH}_3)_5]$ (Octahedral)

Correct Option: A

Solution:

57. Which of the following element do not form complex with EDTA?

- (A) Ca (B) Mg (C) Be (D) Sr

Correct Option: C

Solution:

Be is the only group 2 element that does not form a stable complex with $[\text{EDTA}]^{4-}$. Mg^{2+} and Ca^{2+} have the greatest tendency to form complexes with $[\text{EDTA}]^{4-}$.

58. Which of the following is not a member of chalcogens?

- (A) O (B) S (C) Se (D) Po

Correct Option: D

Solution:

chalcogens are defined as ore-forming elements.

59. Which of the following feature of catalysts is described in reactions given below?

- (i) $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \xrightarrow{\text{Cu/ZnO-Cr}_2\text{O}_3} \text{CH}_3\text{OH}(\text{g})$
 (ii) $\text{CO}(\text{g}) + \text{H}_2(\text{g}) \xrightarrow{\text{Cu}} \text{HCHO}(\text{g})$
 (iii) $\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \xrightarrow{\text{Ni}} \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})$

- (A) Activity (B) Selectivity
 (C) Catalytic promoter (D) Catalytic poison

Correct Option: B

Solution:

Given reactions shows that the selectivity of different catalysts for some reactants is different.

60. Freundlich equation for adsorption of gases (in amount x g) on a solid (in amount of m g) at constant temperature can be expressed as

- (A) $\log \frac{x}{m} = \log p + \frac{1}{n} \log K$
 (B) $\log \frac{x}{m} = \log K + \frac{1}{n} \log p$
 (C) $\frac{x}{m} \propto p^n$
 (D) $\frac{x}{m} = \log p + \frac{1}{n} \log K$

Correct Option: B

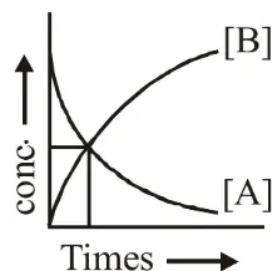
Solution:

According to Freundlich equation,

$$\frac{x}{m} \propto p^{\frac{1}{n}} \text{ or } \frac{x}{m} = K p^{\frac{1}{n}}$$

$$\text{or } \log \frac{x}{m} = \log K p^{\frac{1}{n}} \text{ or } \log \frac{x}{m} = \log K + \frac{1}{n} \log p$$

61. The accompanying figure depicts a change in concentration of species A and B for the reaction $\text{A} \rightarrow \text{B}$, function of time. The point of intersection of the curves represents



- (A) $t_{1/2}$ (B) $t_{3/4}$
 (C) $t_{2/3}$ (D) Data insufficient to predict

Correct Option: A

Solution:

The intersection point indicates the half life of the reaction A when it is converted to B.

62. A 100.0 mL dilute solution of Ag^+ is electrolysed for 15.0 minutes with a current of 1.25 mA and the silver removed completely. What was the initial $[\text{Ag}^+]$?

- (A) 2.32×10^{-1} (B) 2.32×10^{-4}
 (C) 2.32×10^{-3} (D) 1.16×10^{-5}

Correct Option: D

Solution:

No. of moles of

$$Ag^+ = \frac{15 \times 60 \times 1.25 \times 10^{-3}}{96,500} \times \frac{1}{1} = 0.0116 \times 10^{-3}$$

$$\therefore [Ag^+] = \frac{1.16 \times 10^{-5}}{\frac{100}{1000}} = 1.16 \times 10^{-4}$$

63. pH of a 0.1 M monobasic acid is found to be 2. Hence, its osmotic pressure at a given temperature T K is

(A) 0.1 RT (B) 0.11 RT (C) 1.1 RT (D) 0.01 RT

Correct Option: B

Solution:

$$pH = 2$$

$$[H^+] = 0.01M = Cx = 0.1x$$

$$x = 0.1$$

$$i = 1 + x = 1.1$$

$$\pi = i \frac{n}{V} RT = iMRT = 1.1 \times 0.1RT = 0.11RT$$

64. Each edge of a cubic unit cell is 400 pm long. If atomic mass of the element is 120 and its density is 6.25 g/cm³, the crystal lattice is : (use $N_A = 6 \times 10^{23}$)

(A) primitive (B) body centered
(C) face centered (D) end centered

Correct Option: B

Solution:

$$d = \frac{ZM}{N_A a^3} \Rightarrow 6.25 = \frac{Z \times 120}{6 \times 10^{23} \times (4 \times 10^{-8})^3}$$

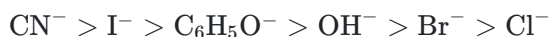
65. Which of the following is strongest nucleophile?

(A) Br⁻
(B) : OH⁻
(C) : CN⁻
(D) C₂H₅O⁻ :

Correct Option: C

Solution:

The strength of nucleophile depends upon the nature of alkyl group R on which nucleophile has to attack and also on the nature of solvent. The order of strength of nucleophiles follows the order :



66. An element X occurs in short period having configuration $ns^2 np^1$. The formula and nature of its oxide is

(A) XO₃, basic
(B) XO₃, acidic
(C) X₂O₃, amphoteric
(D) X₂O₃, basic

Correct Option: C

Solution:

$ns^2 np^1$ is the electronic configuration of III

A period. X₂O₃ (Al₂O₃) is an amphoteric oxide.

67. Beryllium shows diagonal relationship with aluminium. Which of the following similarity is incorrect?

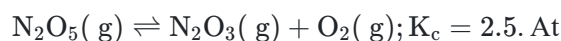
(A) Be forms beryllates and Al forms aluminates
(B) Be(OH)₂ like Al(OH)₃ is basic.
(C) Be like Al is rendered passive by HNO₃.
(D) Be₂C like Al₄C₃ yields methane on hydrolysis.

Correct Option: B

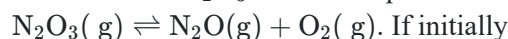
Solution:

The Be(OH)₂ and Al(OH)₃ are amphoteric in nature.

68. When N₂O₅ is heated at certain temperature, it dissociates as



the same time N₂O₃ also decomposes as :

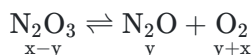
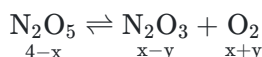


4.0 moles of N₂O₅ are taken in 1.0 litre flask and allowed to dissociate. Concentration of O₂ at equilibrium is 2 . Equilibrium concentration of N₂O₅ is :

(A) 1.0 M (B) 1.5 M (C) 2.166 M (D) 1.846

Correct Option: D

Solution:



$$\therefore [O_2] = x + y = 2.5$$

$$\text{for } N_2O_5, K_c = [N_2O_3][O_2] / [N_2O_5]$$

$$\text{and } 2.5 = \frac{(x+y)(x-y)}{4-x}$$

$$\therefore x = 2.166$$

$$[N_2O_5] = 4 - x = 1.846$$

69. For the reaction taking place at certain temperature



$\text{NH}_2\text{COONH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$,
if equilibrium pressure is 3 X bar then $\Delta_r G^\circ$ would be

- (A) $-RT \ln 9 - 3RT \ln X$
(B) $RT \ln 4 - 3RT \ln X$
(C) $-3RT \ln X$
(D) None of these

Correct Option: D

Solution:

$$\Delta G^\circ = -RT \ln K_p; K_p = (2X)^2 X = 4X^3$$

$$\Delta G^\circ = -RT \ln (4X^3)$$

$$\Delta G^\circ = -RT \ln 4 - 3RT \ln X$$

70. If V is the volume of one molecule of gas under given conditions, the van der Waal's constant *b* is

- (A) 4 V
(B) $\frac{4V}{N_0}$
(C) $\frac{N_0}{4V}$
(D) $4VN_0$

Correct Option: D

Solution:

van der Waals's constant *b* = 4 times the

actual volume of 1 mole molecules = $4VN_0$

71. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?

- (A) $[\text{Ne}]3s^23p^2$
(B) $[\text{Ar}]3d^{10}4s^24p^3$
(C) $[\text{Ne}]3s^23p^1$
(D) $[\text{Ne}]3s^23p^3$

Correct Option: D

Solution:

The smaller the atomic size, larger is the value of ionisation potential. Further the atoms having half filled or fully filled orbitals are comparatively more stable, hence more energy is required to remove the electron from such atoms.

72. If the Planck's constant $h = 6.6 \times 10^{-34} \text{ Js}$, the de Broglie wavelength of a particle having momentum of $3.3 \times 10^{-24} \text{ kg ms}^{-1}$ will be

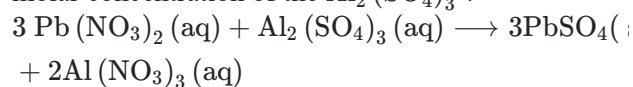
- (A) $0.002 \text{ \AA}$ (B) $0.5 \text{ \AA}$ (C) $2 \text{ \AA}$ (D) $500 \text{ \AA}$

Correct Option: C

Solution:

$$\lambda = \frac{h}{p} = \frac{6.6 \times 10^{-34}}{3.3 \times 10^{-24}} = 2 \times 10^{-10} \text{ m} = 2 \text{ \AA}$$

73. The 25 mL of a 0.15 M solution of lead nitrate $\text{Pb}(\text{NO}_3)_2$ reacts with all of the aluminium sulphate $\text{Al}_2(\text{SO}_4)_3$ present in 20 mL of a solution. What is the molar concentration of the $\text{Al}_2(\text{SO}_4)_3$?



- (A) $6.25 \times 10^{-2} \text{ M}$ (B) $2.421 \times 10^{-2} \text{ M}$
(C) 0.1875 M (D) None of these

Correct Option: A

Solution:

$$\begin{aligned} \text{Molar mass of } \text{Pb}(\text{NO}_3)_2 &= 25 \times 0.15 \\ &= 3.75 \text{ m.moles} \end{aligned}$$

$$\begin{aligned} \text{Molar mass of } \text{Al}_2(\text{SO}_4)_3 &= \frac{1}{3} \times 3.75 = M \times 20 \\ M &= 0.0625 = 6.25 \times 10^{-2} \text{ M} \end{aligned}$$

74. 100 mL O_2 and H_2 kept at same temperature and pressure. What is true about their number of molecules?

- (A) $N_{\text{O}_2} > N_{\text{H}_2}$
(B) $N_{\text{O}_2} < N_{\text{H}_2}$
(C) $N_{\text{O}_2} = N_{\text{H}_2}$
(D) $N_{\text{O}_2} + N_{\text{H}_2} = 1 \text{ mole}$

Correct Option: C

Solution:

This is Avogadro's hypothesis.

According to this, equal volume of all gases contain equal number of molecules under similar condition of temperature and pressure.

75. According to molecular orbital theory which of the following statement about the magnetic character and bond order is correct regarding O_2^+ .

- (A) Paramagnetic and Bond order $< \text{O}_2$

- (B) Paramagnetic and Bond order $> O_2$
 (C) Diamagnetic and Bond order $< O_2$
 (D) Diamagnetic and Bond order $> O_2$

Correct Option: B

Solution:

	O_2	O_2^+
Bond order	2	2.5
Magnetic behaviour	paramagnetic	paramagnetic

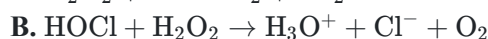
76. For vaporization of water at 1 atmospheric pressure, the values of ΔH and ΔS are $40.63 \text{ kJ mol}^{-1}$ and $108.8 \text{ JK}^{-1} \text{ mol}^{-1}$ respectively. The temperature, when Gibbs energy change (ΔG) for this transformation will be zero, is

- (A) 273.4 K (B) 393.4 K (C) 373.4 K (D) 293.4 K

Correct Option: C

Solution:

77. Consider the reaction



Which of the following statements is correct about H_2O_2 with reference to these reactions? Hydrogen peroxide is ____ :

- (A) An oxidising agent in both (A) and (B)
 (B) An oxidising agent in (A) and reducing agent in (B)
 (C) A reducing agent in (A) and oxidising agent in (B)
 (D) A reducing agent in both (A) and (B)

Correct Option: B

Solution:

An oxidising agent in (A) and reducing agent in (B)

78. The pH of 0.1 M solution of the following salts increases in order

- (A) $NaCl < NH_4Cl < NaCN < HCl$
 (B) $NaCN < NH_4Cl < NaCl < HCl$
 (C) $HCl < NaCl < NaCN < NH_4Cl$
 (D) $HCl < NH_4Cl < NaCl < NaCN$

Correct Option: D

Solution:

HCl is acid has pH less than 7. NH_4Cl is a salt of strong acid. NaCl is a neutrol salt pH = 7. NaCN is a basic salt pH > 7 .

79. Which one of the following cyano complexes would exhibit the lowest value of paramagnetic behaviour?

- (A) $[Cr(CN)_6]^{3-}$
 (B) $[Mn(CN)_6]^{3-}$
 (C) $[Fe(CN)_6]^{3-}$
 (D) $[Co(CN)_6]^{3-}$

Correct Option: D

Solution:

80. Which of the following is the correct increasing order of lone pair of electrons on the central atom?

- (A) $IF_7 < IF_5 < ClF_3 < XeF_2$
 (B) $IF_7 < XeF_2 < ClF_3 < IF_5$
 (C) $IF_7 < ClF_3 < XeF_2 < IF_5$
 (D) $IF_7 < XeF_2 < IF_5^2 < ClF_3^5$

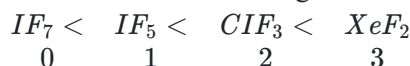
Correct Option: A

Solution:

The number of lone pairs of electrons on central atom in various given species are

Species	Number of lone pairs on central atom
IF_7	Nil
IF_5	1
ClF_3	2
XeF_2	3

Thus the correct increasing order is



0 1 2 3

81. Yesterday, when we were returning from the party, (a) car met with an accident, (b) but we were fortunate to reach our home safely. (c) No error (d)

- (A) B (B) C (C) D (D) A

Correct Option: C

Solution:



82. Despite being (a)/ a good teacher, (b)/ he has no influence on his pupil. (c)/ No error (d)

- (A) A (B) C (C) D (D) B

Correct Option: B

Solution:

83. The likelihood of at least 600,000 deaths being caused annually in India by fine particulate matter pollution in the air is cause for worry, even if the data released by the World Health Organisation are only a modelled estimate. The conclusion that so many deaths could be attributed to particulate matter 2.5 micro metres or less in size is, of course, caveated, since comprehensive measurement of PM2.5 is not yet being done and the linkages between pollution, disease and deaths need further study. What is not in doubt is that residents in many urban areas are forced to breathe unhealthy levels. of particulates, and the smallest of these - PM10 and less can penetrate and get lodged deep in the lungs. The WHO Global Burden of Disease study has been working to estimate pollution-linked health impacts, such as stroke and ischaemic heart disease, acute lower respiratory infection and chronic obstructive pulmonary disease. Data on fine particulates in India show that in several locations the pollutants come from burning of biomass, such as coal, fuel wood, farm litter and cow dung cakes. In highly built-up areas, construction debris, road dust and vehicular exhaust add to the problem. The Prime Minister launched an Air Quality Index last year aimed at improving pollution control. The new data, which the WHO says provide the best evidence available on the terrible toll taken by particulates, should lead to intensified action. A neglected aspect of urban air pollution control is the virtual discarding of the Construction and Demolition Waste Management Rules, notified to sustainably manage debris that is dumped in the cities, creating severe particulate pollution. The Environment Ministry has highlighted the role that debris can play as a resource. Municipal and government contracts are, under the rules, required to utilise up to 20 per cent materials made from construction and demolition waste, and local authorities must place containers to hold debris. This must be implemented without delay. Providing cleaner fuels and scientifically designed cook-stoves to those who have no option but to burn biomass, would have 'a big impact on reducing particulate matter in the northern and eastern States, which are the worst-hit during winter, when biomass is also used for heating. Greening the cities could be made a mission, involving civil society, with a focus on landscaping open spaces and paving all public areas to reduce dust. These measures can result in lower PM10 and PM2.5 levels. Comprehensive measurement of these particulates is currently absent in many cities, a lacuna that needs to be addressed.

Which of the following is/are not true in the context of the passage?

- (A) Eastern and Southern states are worst hit in winter by burning of biomass.
(B) The smallest particulate matter PM2.5 penetrates and gets lodged in lungs.
(C) Data on fine particulates in India show that in several locations the pollutants come from the smoke emitted by vehicles.
(D) None is true

Correct Option: D

Solution:

84. Hey, Nanny, speak about the devil and you are here.
(I) speak at the devil
(II) speak on the devil
(III) speak of the devil
(A) Only (I) is correct (B) Only (II) is correct
(C) Only (III) is correct (D) No correction required

Correct Option: C

Solution:

85. By working part-time and looking after his old mother, he managed to get the best of both worlds.
(I) the best at both worlds
(II) the best of both worlds
(III) the best on both worlds
(A) Only (I) is correct (B) Only (II) is correct
(C) Only (III) is correct (D) No correction required

Correct Option: B

Solution:

86. If sentence (C) "Clinical trials involving human subjects have long been a flashpoint between bioethicists and clinical research organisations (CROs) in India." is the first sentence, what is the order of other sentences in the paragraph?
(A) Such over-volunteering occurs more frequently in bioequivalence studies, which test the metabolisms of generics in healthy subjects.
(B) Landmark amendments to the Drugs and Cosmetics Act in 2013 led to better protection of vulnerable groups such as illiterate people, but more regulation is needed to ensure truly ethical research.
(C) Clinical trials involving human subjects have been a flashpoint between bioethicists and clinical research organisations (CROs) in India.



(D) The big problem plaguing clinical research is an over-representation of low-income groups among trial subjects.

(E) While CROs have argued that more rules will stifle the industry, the truth is that ethical science is often better science.

(F) Sometimes CROs recruit them selectively, exploiting financial need and medical ignorance; at other times people overvolunteer for the money.

(A) ABD FE (B) BDE AF (C) DFA EB (D) BED FA

Correct Option: D

Solution:

After reading all the sentences carefully, we see that sentence A and F should go one after another as both talk about 'over-volunteer'. Moreover, sentence A will follow sentence F because of the presence of the word 'such' which signifies that the subject of the sentence has already been discussed in the previous sentence. So, we have option (c), (d) and (e) to choose from. Considering sentence D which talks about 'a big problem', we find that it can't be the second sentence as no problem of any sort has been dealt in the first sentence, so, option (c) and (e) gets eliminated. Hence, by elimination method, we can conclude that option (d) is the correct choice.

87. He is really feeling under the weather today; he has a terrible cold.

(I) feeling like the weather

(II) feeling over the weather

(III) feeling in the weather

(A) Only (I) is correct (B) Only (III) is correct

(C) Only (II) is correct (D) No correction required

Correct Option: D

Solution:

The phrase used in the sentence is grammatically correct hence, it doesn't require any correction. The meaning of the phrase 'under the weather' is to feel ill.

88. The likelihood of at least 600,000 deaths being caused annually in India by fine particulate matter pollution in the air is cause for worry, even if the data released by the World Health Organisation are only a modelled estimate. The conclusion that so many deaths could be attributed to particulate matter 2.5 micrometres or less in size is, of course, caveated, since comprehensive measurement of PM2.5 is not yet being done and the linkages between pollution, disease and deaths need further study. What is not in doubt is that residents in many urban areas are forced to breathe unhealthy levels of particulates, and the smallest of these - PM10 and less - can penetrate and lodge deep in the lungs. The WHO Global Burden of Disease study has been working to estimate pollution-linked health impacts, such as stroke and ischaemic heart disease, acute lower respiratory infection and chronic obstructive pulmonary disease. Data on fine particulate pollution in India show that in several locations the pollutants come from burning of biomass, such as coal, fuel wood, litter and cow dung cakes. In highly built-up areas, construction debris, road dust and vehicular exhaust are part of the problem. The Prime Minister launched an Air Quality Index last year aimed at improving pollution control. New data, which the WHO says provide the best evidence available on the terrible toll taken by particulates, should lead to intensified action. A neglected aspect of urban pollution control is the virtual discarding of Construction and Demolition Waste Management Rules notified to sustainably manage debris that is dumped in the cities, creating severe particulate pollution. The Environment Ministry highlighted the role that debris can play as a resource. Municipal and government contracts are, under the rules, required to utilise up to 20 per cent materials made from construction and demolition waste, and local authorities must place containers to hold debris. This must be implemented without delay. Providing cleaner fuels and scientifically designed cookstoves to those who have no option but to burn biomass, would have a big impact on reducing fine particulate matter in the northern and eastern states which are the worst-hit during winter, when biomass is also used for heating. Greening the cities could be another mission, involving civil society, with a focus on landscaping open spaces and paving all public areas to reduce dust. These measures can result in lower PM10 and PM2.5 levels. Comprehensive measurement of these particulates is currently absent in many cities, a lacuna that needs to be addressed.

As per the given passage, which of the following is/are the measures for lowering particulate matter in the atmosphere?

(I) Making cleaner fuels available

(II) Landscaping open areas

(III) Providing cooking stoves designed scientifically

(A) Only (I)

(B) Both (I) and (II)

(C) All of the above

(D) None of these

Correct Option: D**Solution:**

89. The likelihood of at least 600,000 deaths being caused annually in India by fine particulate matter pollution in the air is cause for worry, even if the data released by the World Health Organisation are only a modelled estimate. The conclusion that so many deaths could be attributed to particulate matter 2.5 micrometres or less in size is, of course, caveated, since comprehensive measurement of PM2.5 is not yet being done and the linkages between pollution, disease and deaths need further study. What is not in doubt is that residents in many urban areas are forced to breathe unhealthy levels of particulates, and the smallest of these - PM10 and less - can penetrate and get lodged deep in the lungs. The WHO Global Burden of Disease study has been working to estimate pollution-linked health impacts, such as stroke and ischaemic heart disease, acute lower respiratory infection and chronic obstructive pulmonary disease. Data on fine particulates in India show that in several locations the pollutants come from burning of biomass, such as coal, fuel wood, farm litter and cow dung cakes. In highly built-up areas, construction debris, road dust and vehicular exhaust add to the problem. The Prime Minister launched an Air Quality Index last year aimed at improving pollution control. The new data, which the WHO says provide the best evidence available on the terrible toll taken by particulates, should lead to intensified action. A neglected aspect of urban air pollution control is the virtual discarding of the Construction and Demolition Waste Management Rules, notified to sustainably manage debris that is dumped in the cities, creating severe particulate pollution. The Environment Ministry has highlighted the role that debris can play as a resource. Municipal and government contracts are, under the rules, required to utilise up to 20 per cent materials made from construction and demolition waste, and local authorities must place containers to hold debris. This must be implemented without delay. Providing cleaner fuels and scientifically designed cookstoves to those who have no option but to burn biomass, would have a big impact on reducing particulate matter in the northern and eastern States, which are the worst-hit during winter, when biomass is also used for heating. Greening the cities could be made a mission, involving civil society, with a focus on landscaping open spaces and paving all public areas to reduce dust. These measures can result in lower PM10 and PM2.5 levels. Comprehensive measurement of these particulates is currently absent in many cities, a lacuna that needs to be addressed.

If sentence (B) "The Finance Ministry's warning to potential investors in bitcoin and other cryptocurrencies come at a time when a new, seemingly attractive investment area has opened up that few have enough information about." is the first sentence, what is the order of sentences after rearrangement?

- (A) One of the main reasons for this volatility is speculation and the entry into the market of a large number of people lured by the prospect of quick and easy profits
(B) The Finance Ministry's warning to potential investors in bitcoin and other cryptocurrencies has come at a time when a new, seemingly attractive investment area has opened up that few have enough information about.
(C) A number of investors, daunted by the high price of bitcoin, have put their money into less well-established and often spurious cryptocurrencies, only to lose it all
(D) Investment in bitcoin and other cryptocurrencies increased tremendously in India over the past year, but most new users know close to nothing of the technology or how to verify the genuineness of a particular cryptocurrency.
(E) The price of bitcoin, the most popular of all cryptocurrencies, not only shot up by well over 1000% over the course of the last year but also fluctuated wildly.
(F) The government's caution comes on top of other warnings issued by the Reserve Bank of India since 2017
- (A) CDEFA (B) EAFDC (C) DCAEF (D) ECDFA

Correct Option: B**Solution:**

The first sentence talks about the fact that only few investors have idea about bitcoins and other cryptocurrencies (which seems an attractive investment area), so, the finance ministry has warned the potential investors about it. Sentence E will follow the first sentence because it says that 'bitcoin not only shot up well over 1000%.....' which justifies 'attractive investment area' and forms a link. Now, we are left with only option (b) and (c) to choose from. When we consider the sentence F, we can see that this line seems to be a part somewhere in the middle of the paragraph, also, the first line starts with a warning, therefore, it must justify the consequences of the investment in bitcoins and other cryptocurrencies which is justified by sentence C. Hence, option (b) is the correct choice.

90. Passage:

"The likelihood of at least 600,000 deaths being caused annually in India by fine particulate matter pollution in the air is cause for worry, even if the data released by the World Health Organisation are only a modelled estimate. The conclusion that so many deaths could be attributed to particulate matter 2.5 micrometres or less in size is, of course, caveated, since comprehensive measurement of PM2.5 is not yet being done and the linkages between pollution, disease and deaths need further study. What is not in doubt is that residents in many urban areas are forced to breathe unhealthy levels of particulates, and the smallest of these - PM10 and less - can penetrate and get lodged deep in the lungs. The WHO Global Burden of Disease study has been working to estimate pollution-linked health impacts, such as stroke and ischaemic heart disease, acute lower respiratory infection and chronic obstructive pulmonary disease. Data on fine particulates in India show that in several locations the pollutants come from burning of biomass, such as coal, fuel wood, farm litter and cow dung cakes... Comprehensive measurement of these particulates is currently absent in many cities, a lacuna that needs to be addressed."

The conclusion regarding the deaths attributed to particulate matter 2.5 micrometers is considered to be caveated because:

- (A) Measurement of all aspects of PM_{2.5} has been done comprehensively
- (B) Measurement of all aspects of PM_{2.5} is not comprehensive
- (C) Relation between pollution, disease and death is complete
- (D) None of these

Correct Option: B

Solution:

91. Passage:

"The likelihood of at least 600,000 deaths being caused annually in India by fine particulate matter pollution of the air is cause for worry, even if the data released by the World Health Organisation are only a modelled estimate. The conclusion that so many deaths could be attributed to particulate matter 2.5 micrometres or less in size is, of course, caveated, since comprehensive measurement of PM2.5 is not yet being done and the linkages between pollution, disease and deaths need further study. What is not in doubt is that residents in many urban areas are forced to breathe unhealthy levels of particulates, and the smallest of these - PM10 and less - can penetrate and lodge deep in the lungs. The WHO Global Burden of Disease study has been working to estimate pollution-linked health impacts, such as stroke and ischaemic heart disease, acute lower respiratory infection and chronic obstructive pulmonary disease. Data on fine particulate pollution in India show that in several locations the pollutants come from burning of biomass, such as coal, fuel wood, agricultural litter and cow dung cakes... Comprehensive measurement of these particulates is currently absent in many cities. This is a lacuna that needs to be addressed."

According to the WHO Global Burden of Disease s
which of the following is/are pollution linked h
impacts?

- (I) Infection of the lower respiratory system
(II) Chronic obstructive pulmonary disease
(III) Stroke and ischaemic heart disease
- (A) Only (I) (B) Only (III)
(C) Both (I) and (II) (D) All of the above

Correct Option: D

Solution:

92. A group of trees is known as:

- (A) grove (B) parliament
(C) heap (D) hedge

Correct Option: A

Solution:

93. A group of sheep is known as:

- (A) bunch (B) herd (C) band (D) fleet

Correct Option: B

Solution:

94. Choose the word which is most opposite in meaning to the word 'Drowsy'.

- (A) Sleepy (B) Nodding (C) Yawning (D) Wake

Correct Option: D

Solution:

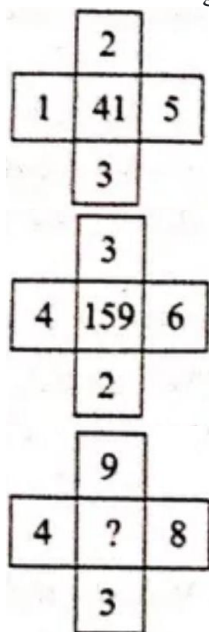
95. Choose the word which is most similar in meaning to the word 'Optimistic'.

- (A) Favourable (B) Gloomy
(C) Hopeful (D) Rude

Correct Option: C

Solution:

96. Select the missing number from the given responses.

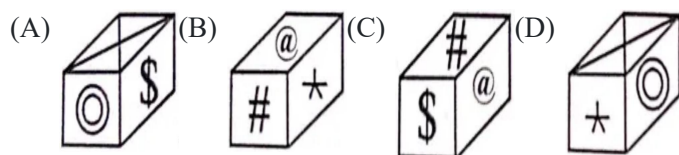
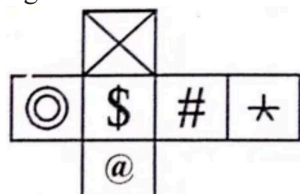


- (A) 888 (B) 788 (C) 848 (D) 842

Correct Option: A

Solution:

97. Which of the following cube in the answer figure cannot be made based on the unfolded cube in the question figure?



Correct Option: B

Solution:

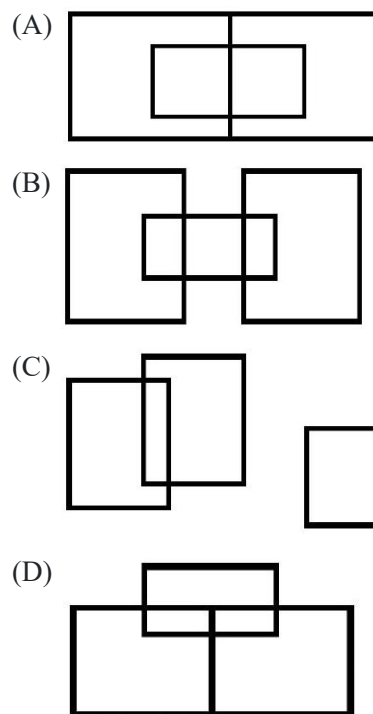
98. If $5\#6 = 121$ and $10\#8 = 324$, then find the value of $23\#14 = ?$

- (A) 1369 (B) 1349 (C) 1331 (D) 725

Correct Option: A

Solution:

99. Which one of the following diagram represents the relationship among Professor, Male and Female.



Correct Option: A

Solution:

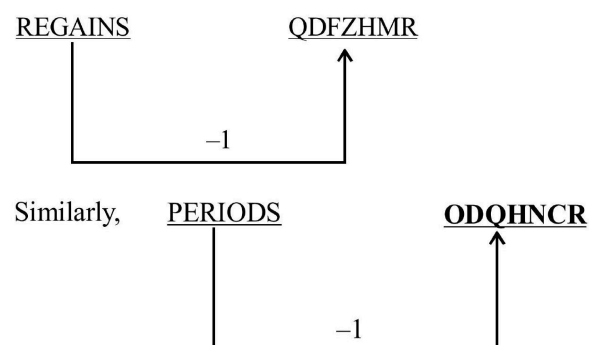
100. In a code language, if REGAINS is coded as QDFZHMR, then the word PERIODS will be coded as

- (A) ODQNHCR (B) ODDQHCR (C) ODQHNCR (D) ODQ

Correct Option: C

Solution:

According to question,



101. Select the related letter/word/ number from the given alternatives.

Distance : Odometer :: ? : Barometer

(A) Humidity (B) Pressure (C) Thickness (D) Wind

Correct Option: B

Solution:

Distance is measured by odometer. Similarly,

Pressure is measured by Barometer.

102. Find the odd word/letters/ number pair/number from the given alternatives.

(A) 24-1614 (B) 270-569 (C) 120-4325 (D) 162-6930

Correct Option: D

Solution:

According to question,

$$24 = 1 \times 6 \times 1 \times 4$$

$$270 = 5 \times 6 \times 9$$

$$120 = 4 \times 3 \times 2 \times 5$$

$$162 = 6 \times 9 \times 3 \times 0 = 0$$

103. Choose the correct alternatives from the given ones that will complete the series.

L_NO_MLLM_OO_ML

(A) MNNNO (B) MONNO (C) MONON (D) MONNN

Correct Option: D

Solution:

According to question,

LMNO/ONML/LMNO/ONML

104. Choose the correct alternatives from the given ones that will complete the series.

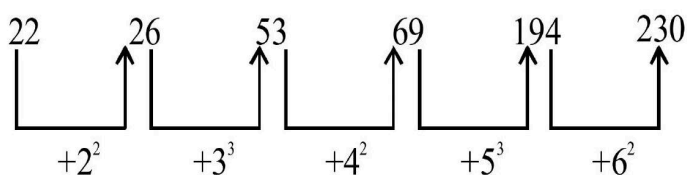
22, 26, 53, 69, 194, ?

(A) 230 (B) 260 (C) 250 (D) 245

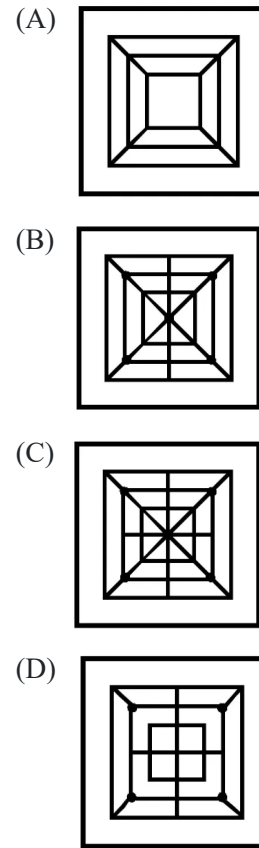
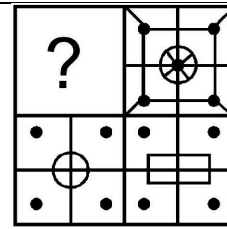
Correct Option: A

Solution:

The pattern is :



105. Identify the figure that will complete the pattern.



Correct Option: C

Solution:

106. The domain of the function $f(x) = \sqrt{x^2 - [x]^2}$, where $[x]$ denotes the greatest integer less than or equal to x , is

(A) $(0, \infty)$ (B) $(-\infty, 0)$
(C) $(-\infty, \infty)$ (D) None of these

Correct Option: D

Solution:

$f(x)$ is defined if $x^2 - [x]^2 \geq 0 \Rightarrow x^2 \geq [x]^2$,

which is true for all positive real x and all negative integers x .

107. If $m \sin \theta = n \sin(\theta + 2\alpha)$ then $\tan(\theta + \alpha)$ is

(A) $\frac{m+n}{m-n} \tan \alpha$ (B) $\frac{m+n}{m-n} \tan \theta$
(C) $\frac{m+n}{m-n} \cot \alpha$ (D) $\frac{m+n}{m-n} \cot \theta$

Correct Option: A**Solution:**

108. Number of solutions of equation $\sin 9\theta = \sin \theta$ in the interval $[0, 2\pi]$ is

- (A) 16 (B) 17 (C) 18 (D) 15

Correct Option: B**Solution:**

Given, $\sin 9\theta = \sin \theta$

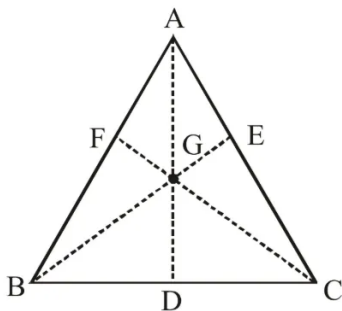
$$\begin{aligned} \Rightarrow \sin 9\theta - \sin \theta &= 0 \\ \Rightarrow 2 \cos \left(\frac{9\theta + \theta}{2} \right) \sin \left(\frac{9\theta - \theta}{2} \right) &= 0 \\ [\because \sin C - \sin D &= 2 \cos \left(\frac{C+D}{2} \right) \sin \left(\frac{C-D}{2} \right)] \\ \Rightarrow 2 \cos 5\theta \sin 4\theta &= 0 \\ \Rightarrow \text{Either } \cos 5\theta &= 0 \text{ or } \sin 4\theta = 0, \text{ also } \theta \in [0, 2\pi] \\ \Rightarrow 5\theta &= (2n+1)\frac{\pi}{2} \\ \text{or } 4\theta &= n\pi \\ \Rightarrow \theta &= (2n+1)\frac{\pi}{10} \text{ or } \theta = \frac{n\pi}{4} \\ \therefore \theta &= \frac{\pi}{10}, \frac{3\pi}{10}, \frac{\pi}{2}, \frac{7\pi}{10}, \frac{9\pi}{10}, \frac{11\pi}{10}, \frac{13\pi}{10}, \frac{3\pi}{2}, \frac{17\pi}{10}, \frac{19\pi}{10} \\ \text{or } 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{4}, 2\pi \end{aligned}$$

$\therefore$ Total number of solutions = 17

($\because \frac{\pi}{2}$ and $\frac{3\pi}{2}$ are common)

109. A pole stands vertically inside a triangular park ABC. If the angle of elevation of the top of the pole from each corner of the park is same, then the foot of the pole is at the

- (A) centroid (B) circumcentre
(C) incentre (D) orthocentre

Correct Option: A**Solution:**

The foot of the pole is at the centroid. Because centroid is the point of intersection of medians AD, BE and CF, which are

the lines joining a vertex with the mid point of opposite side.

110. Let A, B, and C be the angles of a plane triangle and $\tan \frac{A}{2} = \frac{1}{3}, \tan \frac{B}{2} = \frac{2}{3}$. Then $\tan \frac{C}{2}$ is equal to:

- (A) $\frac{7}{9}$ (B) $\frac{2}{9}$
(C) $\frac{1}{3}$ (D) $\frac{2}{3}$

Correct Option: A**Solution:**

111. If the amplitude of $z - 2 - 3i$ is $\frac{\pi}{4}$, then the locus of $z = x + iy$ is

- (A) $x + y - 1 = 0$ (B) $x - y - 1 = 0$
(C) $x + y + 1 = 0$ (D) $x - y + 1 = 0$

Correct Option: D**Solution:**

$$z - 2 - 3i = x + iy - 2 - 3i = (x - 2) + i(y - 3)$$

$$\tan^{-1} \left(\frac{y - 3}{x - 2} \right) = \frac{\pi}{4} \Rightarrow \frac{y - 3}{x - 2} = \tan \frac{\pi}{4} = 1$$

$$\Rightarrow x - y + 1 = 0$$

112. The roots of the equation $x^4 - 2x^3 + x = 380$ are:

- (A) $5, -4, \frac{1 \pm 5\sqrt{-3}}{2}$
(B) $-5, 4, \frac{-1 \pm 5\sqrt{-3}}{2}$
(C) $5, 4, \frac{-1 \pm 5\sqrt{-3}}{2}$
(D) $-5, -4, \frac{1 \pm 5\sqrt{-3}}{2}$

Correct Option: A**Solution:**

Given equation is $x^4 - 2x^3 + x - 380 = 0$

$$\Rightarrow (x^2 - x - 20)(x^2 - x + 19) = 0$$

$$\Rightarrow (x - 5)(x + 4)(x^2 - x + 19) = 0$$

Hence, the required roots of the equation are

$$5, -4, \frac{1 \pm 5\sqrt{-3}}{2}$$

113. Roots of the equation $x^2 + bx - c = 0$ ($b, c > 0$) are

- (A) Both positive (B) Both negative
(C) Of opposite sign (D) None of these



Correct Option: C

Solution:

Since $b, c > 0$

Therefore $\alpha + \beta = -b < 0$ and $\alpha\beta = -c < 0$

Since product of the roots is -ve therefore

roots must be of opposite sign.

114. In how many ways can 12 gentlemen sit around a round table so that three specified gentlemen are always together?

(A) 9! (B) 10! (C) 3!10! (D) 3!9!

Correct Option: D

Solution:

It is obvious by fundamental property of circular permutations.

115. The number of ways in which first, second and third prizes can be given to 5 competitors is

(A) 10 (B) 60 (C) 15 (D) 125

Correct Option: B

Solution:

First prize can be given in 5 ways. Then second prize can be given in 4 ways and the third prize in 3 ways (Since a competitor cannot get two prizes)

and hence the number of ways = $5 \times 4 \times 3 = 60$ ways

116. The coefficient of x^3 in the expansion of $(x - \frac{1}{x})^7$ is :

(A) 14 (B) 21 (C) 28 (D) 35

Correct Option: B

Solution:

117. If $x > 0$, the $1 + \frac{\log_{e^2} x}{1!} + \frac{(\log_{e^2} x)^2}{2!} + \dots =$

(A) x (B) x^2
(C) $2x$ (D) $\sqrt{x}$

Correct Option: D

Solution:

118. If a, b, c are in G.P., then

(A) a^2, b^2, c^2 are in G.P.

(B) $a^2(b+c), c^2(a+b), b^2(a+c)$ are in G.P.

(C) $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ are in G.P.

(D) None of these

Correct Option: A

Solution:

119. The locus of the point of intersection of the lines $x = a(\frac{1-t^2}{1+t^2})$ and $y = \frac{2at}{1+t^2}$ represent (t being a parameter)

(A) circle (B) parabola (C) ellipse (D) hyperbola

Correct Option: A

Solution:

120. The equation of the circle which passes through the point (4, 5) and has its centre at (2, 2) is

(A) $(x-2) + (y-2) = \frac{13}{13}$ (B) $(x-2)^2 + (y-2)^2 = \frac{13}{13}$

(C) $x^2 + y^2 = 13$ (D) $(x-4)^2 + (y-5)^2 = 13$

Correct Option: B

Solution:

As the circle is passing through the point (4, 5) and its centre is (2, 2) so its radius is $\sqrt{(4-2)^2 + (5-2)^2} = \sqrt{13}$.

$\therefore$ The required equation is :

$$(x-2)^2 + (y-2)^2 = 13$$

121. Eccentricity of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ if it passes through point (9, 5) and (12, 4) is

(A) $\sqrt{\frac{3}{4}}$ (B) $\sqrt{\frac{4}{5}}$
(C) $\sqrt{\frac{5}{6}}$ (D) $\sqrt{\frac{6}{7}}$

Correct Option: D

Solution:

$$\text{We have } \frac{81}{a^2} + \frac{25}{b^2} = 1 \quad (1)$$

$$\frac{144}{a^2} + \frac{16}{b^2} = 1$$

From eq. (2) - eq. (1) :



$$\frac{63}{a^2} - \frac{9}{b^2} = 0 \Rightarrow \frac{b^2}{a^2} = \frac{1}{7}$$

$$e = \sqrt{1 - \frac{1}{7}} = \sqrt{\frac{6}{7}}$$

122. Consider the equation of a parabola $y^2 + 4ax = 0$, where $a > 0$. Which of the following is/are correct?

- (A) Tangent at the vertex is $x = 0$
 (B) Directrix of the parabola is $x = 0$
 (C) Vertex of the parabola is not at the origin
 (D) Focus of the parabola is at $(a, 0)$

Correct Option: A

Solution:

Equation of parabola is $y^2 = -4ax$. Its focus is at $(-a, 0)$.

123. The value of $\lim_{n \rightarrow \infty} \frac{1+2+3+\dots+n}{n^2+100}$ is equal to :

- (A) ∞ (B) $\frac{1}{2}$
 (C) 2 (D) 0

Correct Option: B

Solution:

$$\text{Consider } \lim_{n \rightarrow \infty} \frac{1+2+3+\dots+n}{n^2+100}$$

$$= \lim_{n \rightarrow \infty} \frac{n(n+1)}{2(n^2+100)}$$

(By using sum of n natural number $1+2+3+\dots+n$

$$= \frac{n(n+1)}{2})$$

Take n^2 common from N^r and D^r .

$$= \lim_{n \rightarrow \infty} \frac{n^2(1 + \frac{1}{n})}{2n^2(1 + \frac{100}{n^2})} = \frac{1}{2}$$

124. $\lim_{x \rightarrow 0} \sqrt{\frac{x - \sin x}{x + \sin^3 x}}$ is equal to

- (A) 1 (B) 0
 (C) ∞ (D) None of these

Correct Option: B

Solution:

125. The probability of getting 10 in a single throw of three fair dice is

- (A) $\frac{1}{6}$ (B) $\frac{1}{8}$

- (C) $\frac{1}{9}$ (D) $\frac{1}{5}$

Correct Option: B

Solution:

Total outcomes = 216

Now, number of cases of getting 10 from 3 dice in a single throw are

Case 1 $1+3+6 \rightarrow \text{outcomes} = 3! = 6$

Case 2 $1+4+5 \rightarrow \text{outcomes} = 3! = 6$

Case 3 $2+2+6 \rightarrow \text{outcomes} = \frac{3!}{2!} = 3$

Case 4 $2+3+5 \rightarrow \text{outcomes} = 3! = 6$

Case 5 $2+4+4 \rightarrow \text{outcomes} = \frac{3!}{2!} = 3$

Case 6 $3+3+4 \rightarrow \text{outcomes} = \frac{3!}{2!} = 3$

Favourable outcomes = 27

$$\therefore \text{Probability} = \frac{27}{216} = \frac{1}{8}$$

126. Number of solutions of the equation $\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$ are?

- (A) 3 (B) 2 (C) 1 (D) 0

Correct Option: C

Solution:

127. If $A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$ is an orthogonal matrix, then

- (A) $a = -2, b = -1$ (B) $a = 2, b = 1$
 (C) $a = 2, b = -1$ (D) $a = -2, b = 1$

Correct Option: A

Solution:

As A is an orthogonal matrix, $AA^T = I$

$$\Rightarrow \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix} \cdot \frac{1}{3} \begin{bmatrix} 1 & 2 & a \\ 2 & 1 & 2 \\ 2 & -2 & b \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \frac{1}{9} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix} \begin{bmatrix} 1 & 2 & a \\ 2 & 1 & 2 \\ 2 & -2 & b \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 9 & 0 & a+4+2b \\ 0 & 9 & 2a+2-2b \\ a+4+2b & 2a+2-2b & a^2+4+b^2 \end{bmatrix}$$

$$= \begin{bmatrix} 9 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 9 \end{bmatrix}$$

$$\Rightarrow a+4+2b=0, 2a+2-2b=0 \text{ and}$$

$$\Rightarrow a^2+4+b^2=9$$

$$\Rightarrow a+2b+4=0, a-b+1=0 \text{ and}$$

$$a^2+b^2=5$$

$$\Rightarrow a=-2, b=-1$$

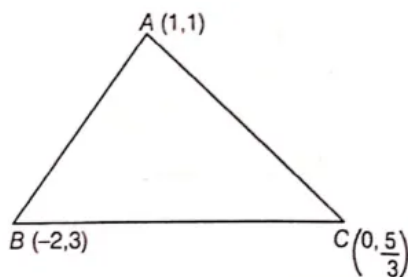
128. The points represented by the complex numbers $1+i$, $-2+3i$, and $\frac{5}{3}i$ on the Argand plane are

- (A) Vertices of an equilateral triangle
 (B) Vertices of an isosceles triangle
 (C) Collinear
 (D) None of the above

Correct Option: C

Solution:

According to question.



Let us find the slopes of AB , BC , and CA .

$$\text{Slope of } AB = \frac{1-3}{1-(-2)} = \frac{-2}{3}$$

$$\text{Slope of } BC = \frac{3-\frac{5}{3}}{-2-0} = \frac{-2}{3}$$

$$\text{Slope of } CA = \frac{\frac{5}{3}-1}{0-1} = \frac{-2}{3}$$

Since the slopes of all the lines are the same, the points are collinear.

129. If matrix $A = \begin{bmatrix} 3 & -2 & 4 \\ 1 & 2 & -1 \\ 0 & 1 & 1 \end{bmatrix}$ and $A^{-1} = \frac{1}{k} \text{adj}(A)$,

then k is

- (A) 7 (B) -7 (C) 15 (D) -11

Correct Option: C

Solution:

$$\text{If } A = \begin{bmatrix} 3 & -2 & 4 \\ 1 & 2 & -1 \\ 0 & 1 & 1 \end{bmatrix}$$

$$\text{and } A^{-1} = \frac{1}{k} \text{adj}(A) \quad \dots(i)$$

$$\text{Also, we know } A^{-1} = \frac{\text{adj}(A)}{|A|}$$

$$\therefore \text{By comparing (i) and (ii) } |A| = k$$

$$\Rightarrow |A| = \begin{vmatrix} 3 & -2 & 4 \\ 1 & 2 & -1 \\ 0 & 1 & 1 \end{vmatrix}$$

$$= 3(2+1) + 2(1+0) + 4(1-0) = 9+2+4 = 15$$

130. If x, y, z are complex numbers, and $\Delta =$

$$\begin{vmatrix} 0 & -y & -z \\ \bar{y} & 0 & -x \\ \bar{z} & \bar{x} & 0 \end{vmatrix} \text{ then } \Delta \text{ is}$$

- (A) purely real (B) purely imaginary
 (C) complex (D) 0

Correct Option: B

Solution:

We have

$$\bar{\Delta} = \begin{vmatrix} 0 & -\bar{y} & -\bar{z} \\ y & 0 & -\bar{x} \\ z & x & 0 \end{vmatrix} = \begin{vmatrix} 0 & y & z \\ -\bar{y} & 0 & x \\ -\bar{z} & -\bar{x} & 0 \end{vmatrix}$$

[Interchanging rows and columns]

$$= (-1)^3 \begin{vmatrix} 0 & -y & -z \\ \bar{y} & 0 & -x \\ \bar{z} & \bar{x} & 0 \end{vmatrix} = -\Delta$$

[Taking -1 common from each row]

$$\therefore \bar{\Delta} + \Delta = 0 \Rightarrow 2 \text{Re}(\Delta) = 0$$

$\therefore \Delta$ is purely imaginary.

131. If $f(x) = \sin x$, when x is rational
 $= \cos x$, when x is irrational }

Then the function is

- (A) discontinuous at $x = n\pi + \frac{\pi}{4}$
 (B) continuous at $x = n\pi + \frac{\pi}{4}$



(C) discontinuous at all x

(D) none of these

Correct Option: B

Solution:

The function can be continuous only at those points for which

$$\sin x = \cos x \Rightarrow x = n\pi + \frac{\pi}{4}$$

132. If $f(x) = \begin{cases} 1, & \text{when } 0 < x \leq \frac{3\pi}{4} \\ 2 \sin \frac{2}{9}x, & \text{when } \frac{3\pi}{4} < x < \pi \end{cases}$

(A) $f(x)$ is continuous at $x = 0$

(B) $f(x)$ is continuous at $x = \pi$

(C) $f(x)$ is continuous at $x = \frac{3\pi}{4}$

(D) $f(x)$ is discontinuous at $x = \frac{3\pi}{4}$

Correct Option: C

Solution:

133. The value of c in $(0, 2)$ satisfying the mean value theorem for the function $f(x) = x(x-1)^2$, $x \in [0, 2]$ is equal to

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

(C) $\frac{1}{3}$ (D) $\frac{2}{3}$

Correct Option: B

Solution:

$$f(x) = x(x-1)^2; x \in [0, 2]$$

$$f'(c) = \frac{f(b) - f(a)}{b - a}; f(2) = 2, f(1) = 0$$

$$f'(x) = 3x^2 - 4x + 1 \Rightarrow f'(c) = 3c^2 - 4c + 1$$

$$\text{Thus, } 3c^2 - 4c + 1 = \frac{f(2) - f(1)}{2 - 1}$$

$$= \frac{2-0}{2-1} = 1 \Rightarrow c = \frac{4}{3}$$

134. If $y = \frac{x}{x+1} + \frac{x+1}{x}$, then $\frac{d^2y}{dx^2}$ at $x = 1$ is equal to

(A) $\frac{7}{4}$ (B) $\frac{7}{8}$

(C) $\frac{1}{4}$ (D) $\frac{-7}{8}$

Correct Option: A

Solution:

Given expression can be written as

$$y = 1 - \frac{1}{x+1} + 1 + \frac{1}{x} \Rightarrow \frac{dy}{dx} = \frac{1}{(1+x)^2} - \frac{1}{x^2}$$

$$\frac{d^2y}{dx^2} = -2(1+x)^{-3} + 2x^{-3} = \frac{-2}{(1+x)^3} + \frac{2}{x^3}$$

$$\text{Now, } \left. \frac{d^2y}{dx^2} \right|_{x=1} = \frac{-2}{(1+1)^3} + \frac{2}{(1)^3} = \frac{-2}{8} + 2 = \frac{7}{4}$$

135. Let $y = e^{2x}$. Then $\left(\frac{d^2y}{dx^2}\right)\left(\frac{d^2x}{dy^2}\right)$ is

(A) 1

(B) e^{-2x}

(C) $2e^{-2x}$

(D) $-2e^{-2x}$

Correct Option: D

Solution:

136. A ball is dropped from a platform 19.6 m high. Its position function is -

(A) $x = -4.9t^2 + 19.6$ ($0 \leq t \leq 1$)

(B) $x = -4.9t^2 + 19.6$ ($0 \leq t \leq 2$)

(C) $x = -9.8t^2 + 19.6$ ($0 \leq t \leq 2$)

(D) $x = -4.9t^2 - 19.6$ ($0 \leq t \leq 2$)

Correct Option: B

Solution:

137. The value of the integral $\int_a^b \frac{\sqrt{x} dx}{\sqrt{x} + \sqrt{a+b-x}}$ is:

(A) π

(B) $\frac{1}{2}(b-a)$

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

(D) $b-a$

Correct Option: B

Solution:

138. $\int \frac{e^{x^2}(2x+x^3)}{(3+x^2)^2} dx$ is equal to:

(A) $\frac{e^{x^2}}{(3+x^2)} + k$

(B) $\frac{1}{2} \frac{e^{x^2}}{(3+x^2)^2} + k$

(C) $\frac{1}{4} \frac{e^{x^2}}{(3+x^2)^2} + k$

(D) $\frac{1}{2} \frac{e^{x^2}}{(3+x^2)} + k$

Correct Option: D

Solution:

139. If $\int_0^a f(2a-x) dx = m$ and $\int_0^a f(x) dx = n$, then $\int_0^{2a} f(x) dx$ is equal to

(A) $2m+n$ (B) $m+2n$ (C) $m-n$ (D) $m+$

Correct Option: D**Solution:**

140. An integrating factor of the differential equation $\sin x \frac{dy}{dx} + 2y \cos x = 1$ is

- (A) $\sin^2 x$ (B) $\frac{2}{\sin x}$
(C) $\log |\sin x|$ (D) $\frac{1}{\sin^2 x}$

Correct Option: A**Solution:**

Given differential equation is

$$\begin{aligned}\sin x \frac{dy}{dx} + 2y \cos x &= 1 \\ \Rightarrow \frac{dy}{dx} + 2y \frac{\cos x}{\sin x} &= \frac{1}{\sin x} \\ \Rightarrow \frac{dy}{dx} + (2 \cot x)y &= \operatorname{cosec} x \\ I.F &= e^{\int 2 \cot x dx} \\ &= e^{2 \log(\sin x)} = \sin^2 x\end{aligned}$$

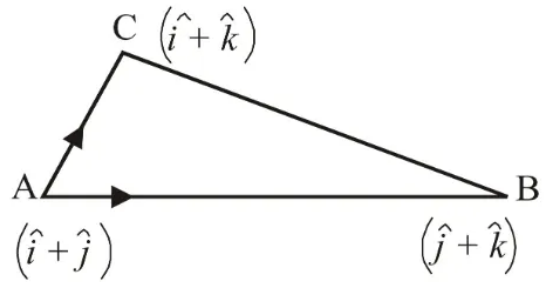
141. The expression satisfying the differential equation $(x^2 - 1) \frac{dy}{dx} + 2xy = 1$ is
- (A) $x^2 y - xy^2 = c$ (B) $(y^2 - 1)x = y + c$
(C) $(x^2 - 1)y = x + c$ (D) none of these

Correct Option: C**Solution:**

142. Let $\vec{a} = \hat{i} - \hat{k}$, $\vec{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}$ and $\vec{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$. Then $[\vec{a}, \vec{b}, \vec{c}]$ depends on
- (A) only y (B) only x
(C) both x and y (D) neither x nor y

Correct Option: D**Solution:**

143. If $\hat{i} + \hat{j}$, $\hat{j} + \hat{k}$, $\hat{i} + \hat{k}$ are the position vectors of the vertices of a triangle ABC taken in order, then $\angle A$ is equal to
- (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{5}$
(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

Correct Option: D**Solution:**Now, $\vec{AC} = \hat{k} - \hat{j}$ and $\vec{AB} = \hat{k} - \hat{i}$ Let θ be the angle between $\vec{AC}$ and $\vec{AB}$.

$$\cos \theta = \frac{1-0-0+0}{\sqrt{2}\sqrt{2}} = \frac{1}{2} \Rightarrow \theta = 60^\circ = \frac{\pi}{3}$$

144. The projection of line joining $(3, 4, 5)$ and $(4, 6, 3)$ on the line joining $(-1, 2, 4)$ and $(1, 0, 5)$ is
- (A) $\frac{4}{3}$ (B) $\frac{2}{3}$
(C) $\frac{8}{3}$ (D) $\frac{1}{3}$

Correct Option: A**Solution:**

$$\begin{aligned}\text{Let } A &= (3, 4, 5), P = (-1, 2, 4) \\ B &= (4, 6, 3) \text{ and } Q = (1, 0, 5) \\ \therefore \text{Dr's of line } AB &\text{ are } (4-3), (6-4), (3-5) \\ &= 1, 2, -2 \\ \text{and Dr's of line } PQ &\text{ are } (1+1), (0-2), (5-4) \\ &= 2, -2, 1 \\ \therefore \text{Dc's of line } PQ &= \frac{2}{\sqrt{2^2 + (-2)^2 + 1}}, \frac{-2}{3}, \frac{1}{3} \\ &= \frac{2}{3}, \frac{-2}{3}, \frac{1}{3}\end{aligned}$$

$$\therefore \text{Projection of line segment } AB \text{ on the line } PQ \text{ is } \left| \frac{2}{3}(1) + \left(\frac{-2}{3}\right)(2) + \left(\frac{1}{3}\right)(-2) \right| = \frac{4}{3}$$

145. Which of the following statements is correct?
- (A) Every L.P.P. admits an optimal solution.
(B) A L.P.P. admits a unique optimal solution.
(C) If a L.P.P. admits two optimal solutions, it has a finite number of optimal solutions.
(D) The set of all feasible solutions of a L.P.P. is not convex set.

Correct Option: C**Solution:**



146. If the constraints in a linear programming problem are changed then

- (A) The problem is to be re-evaluated.
 (B) Solution is not defined.
 (C) The objective function has to be modified.
 (D) The change in constraints is ignored.

Correct Option: A

Solution:

147. In a binomial distribution, the mean is 4 and variance is 3. Then its mode is:

- (A) 5 (B) 6
 (C) 4 (D) None of these

Correct Option: C

Solution:

In Binomial distribution, Mean = np, Variance = npq and the mode is r if for $x = r$, the probability function $p(x)$ is maximum.

Given $np = 4$ and $npq = 3$

$$\therefore q = \frac{3}{4} \text{ and } p = 1 - q = 1 - \frac{3}{4} = \frac{1}{4}$$

$$\text{Also, } n = \frac{4}{p} = \frac{4}{1/4} = 16$$

$$\text{Now, } (n+1)p = (16+1)\frac{1}{4} = \frac{17}{4} = 4 + \frac{1}{4}$$

$\Rightarrow$ The distribution will have unique mode (unimodal) & the mode = 4

148. The sum $1 + \frac{1+a}{2!} + \frac{1+a+a^2}{3!} + \dots \infty$ is equal to

- (A) e^a (B) $\frac{e^a - e}{a-1}$
 (C) $(a-1)e^a$ (D) $(a+1)e^a$

Correct Option: B

Solution:

The given series is

$$1 + \frac{1+a}{2!} + \frac{1+a+a^2}{3!} + \frac{1+a+a^2+a^3}{4!} + \dots$$

$$\text{Here, } T_n = \frac{1+a+a^2+a^3+\dots \text{ to } n \text{ terms}}{n!}$$

$$= \frac{1(1-a^n)}{(1-a)(n!)} = \frac{1}{1-a} \left(\frac{1-a^n}{n!} \right)$$

$$\therefore T_1 + T_2 + T_3 + \dots \text{ to } \infty$$

$$= \frac{1}{1-a} \left[\frac{1-a}{1!} + \frac{1-a^2}{2!} + \frac{1-a^3}{3!} + \dots \text{ to } \infty \right]$$

$$= \frac{1}{1-a} \left[\left(\frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \dots \text{ to } \infty \right) - \right.$$

$$\left. \left(\frac{a}{1!} + \frac{a^2}{2!} + \frac{a^3}{3!} + \dots \text{ to } \infty \right) \right]$$

$$= \frac{1}{1-a} [(e-1) - (e^a-1)]$$

$$= \frac{e-e^a}{1-a} = \frac{e^a-e}{a-1}$$

149. The Boolean expression

$\sim (p \vee q) \vee (\sim p \wedge q)$ is equivalent to:

- (A) p (B) q (C) $\sim q$ (D) $\sim p$

Correct Option: D

Solution:

$$\sim (p \vee q) \vee (\sim p \wedge q)$$

$$\equiv (\sim p \wedge \sim q) \vee (\sim p \wedge q)$$

$$\Rightarrow \sim p \wedge (\sim q \vee q)$$

$$\Rightarrow \sim p \wedge t \equiv \sim p$$

150. If in a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately

- (A) 25.5 (B) 24.0 (C) 22.0 (D) 20.5

Correct Option: B

Solution:

$$\text{We know that, } Mode = 3Median - 2Mean = 3(22) - 2(21) = 66 - 42 = 24$$

BITSAT Solved Paper 2018 - ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	B	D	A	C	B	B	B	B	B
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	C	C	B	D	B	A	B	C	B	B
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	B	A	C	A	C	A	A	B	B	A
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	D	C	B	B	C	D	D	A	D	D
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	D	C	B	D	C	D	B	A	A	A
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	C	B	C	B	A	A	C	D	B	B
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	A	D	B	B	C	C	B	D	D	D
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	D	C	A	C	B	C	B	D	D	A
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	C	B	D	C	B	D	D	D	B	B
Que.	91	92	93	94	95	96	97	98	99	100
Ans.	D	A	B	D	C	A	B	A	A	C
Que.	101	102	103	104	105	106	107	108	109	110
Ans.	B	D	D	A	C	D	A	B	A	A
Que.	111	112	113	114	115	116	117	118	119	120
Ans.	D	A	C	D	B	B	D	A	A	B
Que.	121	122	123	124	125	126	127	128	129	130

Ans.	D	A	B	B	B	C	A	C	C	B
Que.	131	132	133	134	135	136	137	138	139	140
Ans.	B	C	B	A	D	B	B	D	D	A
Que.	141	142	143	144	145	146	147	148	149	150
Ans.	C	D	D	A	C	A	C	B	D	B