

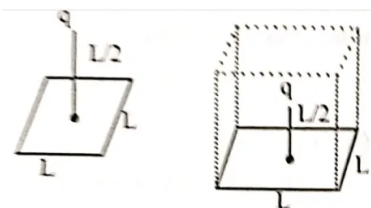
BITSAT Solved Paper 2020

1. A charge $+q$ is at a distance $\frac{L}{2}$ above a square of side L . Then what is the flux linked with the surface?

(A) $\frac{q}{4\epsilon_0}$ (B) $\frac{2q}{3\epsilon_0}$
(C) $\frac{q}{6\epsilon_0}$ (D) $\frac{6q}{\epsilon_0}$

Correct Option: C

Solution:



The given square of side L may be considered as one of the faces of a cube with edge L . Then given charge q will be considered to be placed at the centre of the cube. Then according to Gauss's theorem, the magnitude of the electric flux through the faces (six) of the cube is given by

$$\phi = \frac{q}{\epsilon_0}$$

Hence electric flux through one face of the cube for the given square will be

$$\phi' = \frac{1}{6}\phi = \frac{q}{6\epsilon_0}$$

2. A body of mass 2 kg is placed on a horizontal surface having kinetic friction 0.4 and static friction coefficient 0.5 . If the force applied on the body is 2.5 N , then the frictional force acting on the body will be $[g = 10\text{ ms}^{-2}]$

(A) 8 N (B) 10 N (C) 20 N (D) 2.5 N

Correct Option: D

Solution:

3. From a 200 m high terrace, one ball is thrown upwards with speed of 10 ms^{-1} and another is thrown vertically downwards at the same speed simultaneously. The time difference of their reaching the ground will be nearest to:
- (A) 12 s (B) 6 s (C) 2 s (D) 1 s

Correct Option: C

Solution:

4. In series combination of R , L and C with an A.C. source at resonance, if $R = 20\text{ ohm}$, then impedance Z of the combination is
- (A) 20 ohm (B) zero (C) 10 ohm (D) 400 ohm

Correct Option: A

Solution:

5. The energy of electron in the n th orbit of hydrogen atom is expressed as $E_n = \frac{-13.6}{n^2}\text{ eV}$. The shortest and longest wavelength of Lyman series will be
- (A) $910\text{ \AA}$, $1213\text{ \AA}$ (B) $5463\text{ \AA}$, $7858\text{ \AA}$
(C) $1315\text{ \AA}$, $1530\text{ \AA}$ (D) None of these

Correct Option: A

Solution:

6. The potential energy of a satellite of mass m and revolving at a height R_e above the surface of earth where $R_e = r$ radius of earth, is
- (A) $-mgR_e$
(B) $\frac{-mgR_e}{2}$
(C) $\frac{-mgR_e}{3}$
(D) $\frac{-mgR_e}{4}$

Correct Option: B

Solution:

At a height h above the surface of earth the gravitational potential energy of the particle of mass m is

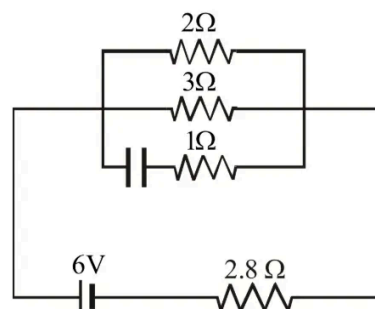
$$U_h = -\frac{GM_em}{R_e+h}$$

Where M_e & R_e are the mass & radius of earth respectively.

In this question, since $h = R_e$

$$\text{So } U_{h=R_e} = -\frac{GM_em}{2R_e} = \frac{-mgR_e}{2}$$

7. Determine the current in 2Ω resistor.

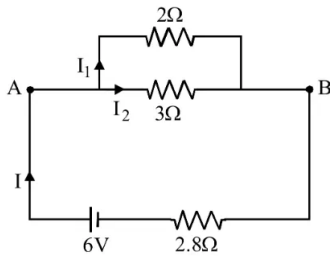


(A) 1 A (B) 1.5 A (C) 0.9 A (D) 0.6 A

Correct Option: C

Solution:

At steady state the capacitor will be fully charged and thus there will be no current in the 1Ω resistance. So the effective circuit becomes



Net current from the 6 V battery,

$$I = \frac{6}{\left(\frac{2 \times 3}{2+3}\right) + \frac{2.8}{1}} = \frac{6}{1.2 + 2.8} = \frac{3}{2} = 1.5 \text{ A}$$

Between A and B, voltage is same in both

resistances, $2I_1 = 3I_2$ where

$$I_1 + I_2 = I = 1.5$$

$$\Rightarrow 2I_1 = 3(1.5 - I_1) \Rightarrow I_1 = 0.9 \text{ A}$$

8. A nucleus splits into two nuclear parts which have their velocity ratio equal to 2 : 1. What will be the ratio of their nuclear radius?

- (A) $2^{1/3} : 1$ (B) $1 : 2^{1/3}$
(C) $3^{1/2} : 1$ (D) $1 : 3^{1/2}$

Correct Option: B

Solution:

As momentum is conserved, therefore

$$\frac{m_1}{m_2} = \frac{A_1}{A_2} = \frac{v_2}{v_1} = \frac{1}{2}$$

$$\therefore \frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{1}{2}\right)^{1/3} = 1 : 2^{1/3}$$

9. An electron moves in a circular arc of radius 10 m at a constant speed of 2×10^7 m/s with its plane of motion normal to a magnetic flux density of 10^{-5} T. What will be the value of specific charge of the electron?

- (A) $2 \times 10^4 \text{ C kg}^{-1}$
(B) $2 \times 10^5 \text{ C kg}^{-1}$
(C) $5 \times 10^6 \text{ C kg}^{-1}$
(D) $2 \times 10^{11} \text{ C kg}^{-1}$

Correct Option: D

Solution:

$$Bqv = mv^2/r \text{ or } q/m = v/rB.$$

10. Three charge q , Q and $4q$ are placed in a straight line of length l at points distant 0 , $\frac{l}{2}$ and l respectively from one end. In order to make the net force on q zero, the charge Q must be equal to

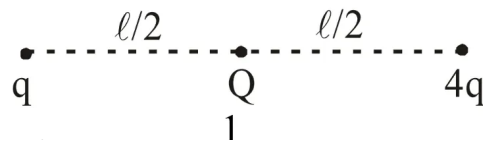
- (A) $-q$ (B) $-2q$
(C) $\frac{-q}{2}$ (D) q

Correct Option: A

Solution:

$$(F_{\text{net}})_q = 0$$

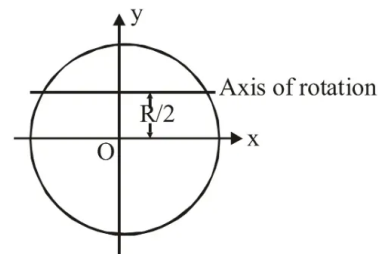
$$\Rightarrow k \frac{Qq}{\left(\frac{l}{2}\right)^2} + k \frac{4q^2}{l^2} = 0$$



$$\text{where } k = \frac{1}{4\pi\epsilon_0}$$

$$\Rightarrow 4Qq + 4q^2 = 0 \Rightarrow Q = -q$$

11. M.I of a circular loop of radius R about the axis in figure is



- (A) MR^2 (B) $(3/4)MR^2$
(C) $MR^2/2$ (D) $2MR^2$

Correct Option: B

Solution:

Use theorem of parallel axes.

12. A thin sheet of glass ($\mu = 1.5$) of thickness 6 micron introduced in the path of one of the interfering beams in a double slit experiment shifts the central fringe to a position previously occupied by fifth bright fringe. Then the wavelength of light used is

- (A) $6000\text{\AA}$ (B) $3000\text{\AA}$ (C) $4500\text{\AA}$ (D) $7500\text{\AA}$

Correct Option: A

Solution:

$$n\lambda = (\mu - 1)t;$$

$$\therefore \lambda = \frac{(\mu - 1)t}{n} = \frac{(1.5 - 1) \times 6 \times 10^{-6}}{5} = 6000 \text{ \AA}$$

13. A whistle of frequency 1000 Hz is sounded on a car travelling towards a cliff with velocity of 18 ms^{-1} normal to the cliff. If $c = 330 \text{ m s}^{-1}$, then the apparent frequency of the echo as heard by the car driver is nearly

(A) 1115 Hz (B) 115 Hz (C) 67 Hz (D) 47.2 Hz

Correct Option: A

Solution:

By the concept of acoustic, the observer and source are moving towards each other, each with a velocity of 18 m s^{-1} .

$$\therefore v' = \frac{330+18}{330-18} \times 1000 \approx 1115 \text{ Hz}$$

14. A solid cylinder and a hollow cylinder both of the same mass and same external diameter are released from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first?

(A) Solid cylinder (B) Both together
(C) One with higher density (D) Hollow cylinder

Correct Option: A

Solution:

Solid cylinder reaches the bottom first

because for solid cylinder $\frac{K^2}{R^2} = \frac{1}{2}$ and for

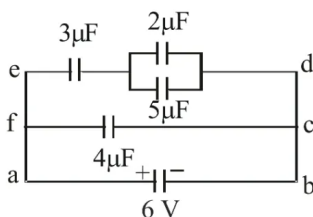
hollow cylinder, $\frac{K^2}{R^2} = 1$.

Acceleration down the inclined plane

$$\propto \frac{1}{1 + \frac{K^2}{R^2}}. \text{ Solid cylinder has greater}$$

acceleration. It reaches the bottom first.

15. In the circuit given below, the charge in μC , on the capacitor having $5\mu\text{ F}$ is



(A) 4.5 (B) 9 (C) 7 (D) 15

Correct Option: B

Solution:

Potential difference across the branch de is 6 V. Net capacitance of de branch is $2.1\mu\text{ F}$

$$So, q = CV$$

$$\Rightarrow q = 2.1 \times 6\mu\text{ C} \Rightarrow q = 12.6\mu\text{ C}$$

Potential across $3\mu\text{ F}$ capacitance is

$$V = \frac{12.6}{3} = 4.2\text{ volt}$$

Potential across 2 and 5 combination in parallel is $6 - 4.2 = 1.8 \text{ V}$

$$So, q' = (1.8)(5) = 9\mu\text{ C}$$

16. An instantaneous displacement of a simple harmonic oscillator is $x = A \cos(\omega t + \pi/4)$. Its speed will be maximum at time

(A) $\pi/4\omega$ (B) $\pi/2\omega$
(C) π/ω (D) $2\pi/\omega$

Correct Option: A

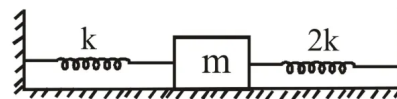
Solution:

$$\text{Velocity, } v = \frac{dx}{dt} = -A\omega \sin(\omega t + \pi/4)$$

Velocity will be maximum, when

$$\omega t + \pi/4 = \pi/2 \text{ or } \omega t = \pi/2 - \pi/4 = \pi/4 \text{ or } t = \pi/4\omega$$

17. Frequency of oscillation is proportional to



(A) $\sqrt{\frac{3k}{m}}$
(B) $\sqrt{\frac{k}{m}}$
(C) $\sqrt{\frac{2k}{m}}$
(D) $\sqrt{\frac{m}{3k}}$

Correct Option: A

Solution:



Let mass is displaced towards left by x then force on mass
 $= -kx - 2kx = -3kx$

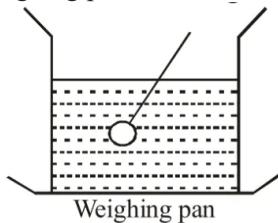
[negative sign is taken because force is opposite to the direction of motion]

$$\Rightarrow F = -3kx = -m^2x \Rightarrow \omega = \sqrt{\frac{3k}{m}}$$

$$f = \frac{\omega}{2\pi} = \frac{1}{2\pi} \sqrt{\frac{3k}{m}}$$

Thus it is propotional to $\sqrt{3k/m}$

18. A vessel with water is placed on a weighing pan and it reads 600 g . Now a ball of mass 40 g and density 0.80 g cm^{-3} is sunk into the water with a pin of negligible volume, as shown in figure keeping it sunk. The weighing pan will show a reading



- (A) 600 g (B) 550 g (C) 650 g (D) 632 g

Correct Option: C

Solution:

$$\text{Volume of ball} = \frac{40}{0.8} = 50 \text{ cm}^3$$

Downthrust on water = 50 g.

Therefore reading is 650 g .

19. If the the earth is at one-fourth of its present distance from the sun, the duration of year will be
- (A) half the present year (B) one-eight the present year
- (C) one-fourth the present year (D) one-sixth the present year

Correct Option: B

Solution:

20. The engine of a truck moving along a straight road delivers constant power. The distance travelled by the truck in time t is proportional to
- (A) t (B) t^2 (C) $\sqrt{t}$ (D) $t^{3/2}$

Correct Option: D

Solution:

$$\frac{mv^2}{t} = \frac{ms^2}{t^3}$$

since both P and m are constants

$$\therefore \frac{s^2}{t^3} = \text{constant}$$

21. A boy pushes a toy box 2.0 m along the floor by means of a force of 10 N directed downward at an angle of 60° to the horizontal. The work done by the boy is
- (A) 6 J (B) 8 J (C) 10 J (D) 12 J

Correct Option: C

Solution:

$$W = F \times s \times \cos \theta = 10 \times 2 \times \cos 60^\circ = 10 \text{ J.}$$

22. The coefficient of friction between the rubber tyres and the road way is 0.25. The maximum speed with which a car can be driven round a curve of radius 20 m without skidding is ($g = 9.8 \text{ m/s}^2$)
- (A) 5 m/s (B) 7 m/s
- (C) 10 m/s (D) 14 m/s

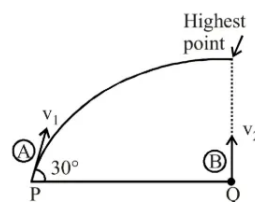
Correct Option: B

Solution:

$$\mu mg = mv^2/r \text{ or } v = \sqrt{\mu gr}$$

$$\text{or } v = \sqrt{(0.25 \times 9.8 \times 20)} = 7 \text{ m/s}$$

23. A projectile A is thrown at an angle of 30° to the horizontal from point P . At the same time, another projectile B is thrown with velocity v_2 upwards from the point Q vertically below the highest point. For B to collide with A, $\frac{v_2}{v_1}$ should be



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

Correct Option: C

Solution:

This happens when vertical velocity of both are same.

$$\therefore v_2 = v_1 \sin 30^\circ \text{ or } \frac{v_2}{v_1} = \frac{1}{2}$$

24. The r.m.s. velocity of oxygen molecule at 16°C is 474 m/sec. The r.m.s. velocity in m/s of hydrogen molecule at 127°C is

(A) 1603 (B) 1896 (C) 2230.59 (D) 2730

Correct Option: C

Solution:

$$v_{\text{oxg.}} = \sqrt{\frac{3R \times 289}{32}} \quad (v_{\text{rms}} = \sqrt{\frac{3RT}{M}})$$

$$v_H = \sqrt{\frac{3R \times 400}{2}} \text{ so } v_H = 2230.59 \text{ m/sec}$$

25. The heat generated in a circuit is given by $Q = I^2 R t$, where I is current, R is resistance and t is time. If the percentage errors in measuring I , R and t are 2%, 1% and 1% respectively, then the maximum error in measuring heat will be

(A) 2% (B) 3% (C) 4% (D) 6%

Correct Option: D

Solution:

$$\begin{aligned} \frac{\Delta Q}{Q} \times 100 &= \frac{2\Delta I}{I} \times 100 + \frac{\Delta R}{R} \times 100 + \frac{\Delta t}{t} \times 100 \\ &= 2 \times 2\% + 1\% + 1\% = 6\% \end{aligned}$$

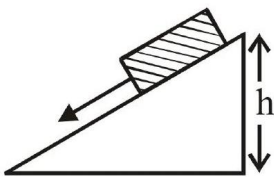
26. A body of density ρ' is dropped from rest at a height h into a lake of density ρ where $\rho > \rho'$ neglecting all dissipative forces, calculate the maximum depth to which the body sinks before returning to float on the surface :

- (A) $\frac{h}{\rho - \rho'}$
 (B) $\frac{h\rho'}{\rho}$
 (C) $\frac{h\rho'}{\rho - \rho'}$
 (D) $\frac{h\rho}{\rho - \rho'}$

Correct Option: C

Solution:

The effective acceleration of the body is given by: $g' = (1 - \frac{\rho}{\rho'})g$



Now, the depth to which the body sinks is: $h' = (\frac{u^2}{2g'}) = \frac{2gh}{2g'} = \frac{gh}{g'} = \frac{h \times \rho'}{\rho - \rho'}$

27. A vessel of depth $2d$ cm is half filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2 . The apparent depth of the vessel seen perpendicularly is

- (A) $(\frac{\mu_1 \mu_2}{\mu_1 + \mu_2}) d$
 (B) $(\frac{1}{\mu_1} + \frac{1}{\mu_2}) d$
 (C) $(\frac{1}{\mu_1} + \frac{1}{\mu_2}) 2d$
 (D) $(\frac{1}{\mu_1 \mu_2}) 2d$

Correct Option: B

Solution:

Apparent depth = $d/\mu_1 + d/\mu_2$.

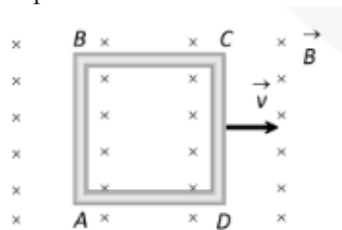
28. A plane electromagnetic wave is incident on a plane surface of area A normally, and is perfectly reflected. If energy E strikes the surface in time t then average pressure exerted on the surface is (c = speed of light)

- (A) Zero (B) $\frac{E}{A t c}$
 (C) $\frac{2E}{A t c}$ (D) $\frac{E}{c}$

Correct Option: C

Solution:

29. A conducting square loop of side L and resistance moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere. The current induced in the loop is:



- (A) $\frac{BLv}{R}$ clockwise (B) $\frac{BLv}{R}$ anticlockwise
 (C) $\frac{2BLv}{R}$ anticlockwise (D) Zero

Correct Option: D

Solution:

No flux change is taking place because magnetic field exists everywhere and is constant in time and space.

30. A crystal has a coefficient of expansion $13 \times 10^{-7}/^{\circ}\text{C}$ in one direction and $231 \times 10^{-7}/^{\circ}\text{C}$ in every direction right angles to it. Then cubical coefficient of expansion is:



- (A) $462 \times 10^{-7} / ^\circ\text{C}$
 (B) $244 \times 10^{-7} / ^\circ\text{C}$
 (C) $475 \times 10^{-7} / ^\circ\text{C}$
 (D) $257 \times 10^{-7} / ^\circ\text{C}$

Correct Option: C

Solution:

$$\gamma = \alpha_x + \alpha_y + \alpha_z \text{ (for anisotropic substance)}$$

$$\gamma = 13 \times 10^{-7} + 2 \times 231 \times 10^{-7}$$

$$\gamma = 475 \times 10^{-7} / ^\circ\text{C}$$

31. The equation of a projectile is $y = \sqrt{3}x - \frac{gx^2}{2}$. The angle of projection is given by

- (A) $\tan \theta = \frac{1}{\sqrt{3}}$ (B) $\tan \theta = \sqrt{3}$
 (C) $\frac{\pi}{2}$ (D) zero

Correct Option: B

Solution:

Comparing the given equation with

$$y = x \tan \theta - \frac{gx^2}{2u^2 \cos^2 \theta}, \text{ we get}$$

$$\tan \theta = \sqrt{3} \text{ or } \theta = 60^\circ.$$

32. In an adiabatic process, the pressure is increased by $\frac{2}{3}\%$. If $\gamma = \frac{3}{2}$, then the volume decreases by nearly
- (A) $\frac{4}{9}\%$ (B) $\frac{2}{3}\%$
 (C) 11 (D) $\frac{9}{4}\%$

Correct Option: A

Solution:

$$PV^{3/2} = K, \log P + \frac{3}{2} \log V = \log K$$

$$\frac{\Delta P}{P} + \frac{3}{2} \frac{\Delta V}{V} = 0$$

$$\frac{\Delta V}{V} = -\frac{2}{3} \frac{\Delta P}{P}$$

$$\text{or } \frac{\Delta V}{V} = \left(-\frac{2}{3}\right) \left(\frac{2}{3}\right) = -\frac{4}{9}$$

33. If the forward voltage in a semiconductor diode is changed from 0.5 V to 0.7 V, then the forward current changes by 1.0 mA. The forward resistance of diode junction will be:

- (A) 100 (B) 120 (C) 200 (D) 240
 $\backslash \Omega$ $\backslash \Omega$ $\backslash \Omega$ $\backslash \Omega$

Correct Option: C

Solution:

$$r_f = \frac{\Delta V}{\Delta i} = \frac{0.7 - 0.5}{1.0 \times 10^{-3}}$$

34. An organ pipe, open from both ends, produces 5 beats per second when vibrated with a source of frequency 200 Hz. The second harmonic of the same pipe produces 10 beats per second with a source of frequency 420 Hz. The fundamental frequency of the organ pipe is
- (A) 205 Hz (B) 195 Hz (C) 190 Hz (D) 210 Hz

Correct Option: A

Solution:

Let the fundamental frequency of organ pipe be f

$$\text{Case I: } f = 200 \pm 5 = 205 \text{ Hz or } 195 \text{ Hz}$$

Case II : frequency of 2nd harmonic of organ

pipe = $2f$ (as is clear from the second figure)

$$2f = 420 \pm 10 \text{ or } f = 210 \pm 5 \text{ or}$$

$$f = 205 \text{ or } 215$$

35. There are two wires of the same material and the same length while the diameter of second wire is two times the diameter of first wire, then ratio of extension produced in the wires by applying the same load will be
- (A) 1 : 1 (B) 2 : 1 (C) 1 : 2 (D) 4 : 1

Correct Option: D

Solution:

$$l = \frac{FL}{AY} \therefore l \propto \frac{1}{r^2} (F, L \text{ and } Y \text{ are constant})$$

$$\frac{l_1}{l_2} = \left(\frac{r_2}{r_1}\right)^2 = (2)^2 = 4$$

36. The escape velocity for a planet is v_e . A tunnel is dug along a diameter of the planet and a small body is dropped into it at the surface. When the body reaches the centre of the planet, its speed will be
- (A) v_s (B) $\frac{v_e}{\sqrt{2}}$
 (C) $\frac{v_e}{2}$ (D) zero

Correct Option: B

Solution:

$$K_{\text{surface}} + U_{\text{surface}} = K_{\text{centre}} + U_{\text{centre}}$$

$$\Rightarrow 0 - \frac{GMm}{R} = \frac{1}{2}mv^2 - \frac{3GMm}{2R}$$

$$\Rightarrow \frac{v^2}{2} = \frac{3GM}{2R} - \frac{GM}{R}$$

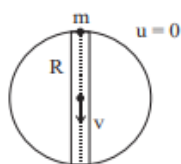
$$\Rightarrow \frac{v^2}{2} = \frac{3GM - 2GM}{2R}$$

Using COME,

$$\Rightarrow v^2 = \frac{GM}{R}$$

$$\Rightarrow V = \sqrt{\frac{GM}{R}} = \frac{1}{\sqrt{2}} \sqrt{\frac{2GM}{R}}$$

$$= \frac{V_s}{\sqrt{2}}$$



37. Two wires A and B of the same material, having radii in the ratio 1 : 2 carry currents in the ratio 4 : 1. The ratio of drift speed of electrons in A and B is

(A) 16 : 1 (B) 1 : 16 (C) 1 : 4 (D) 4 : 1

Correct Option: A

Solution:

$$4i = neAV_D$$

$$i = ne(4A)V'_D$$

$$4 = \frac{V_D}{4V'_D}$$

$$\frac{V_D}{V'_D} = 16 : 1$$

38. A particle executing simple harmonic motion along y-axis has its motion described by the equation $y = A \sin(\omega t) + B$. The amplitude of the simple harmonic motion is

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

Correct Option: A

Solution:

The amplitude is a maximum displacement from the mean position.

39. A wheel is rotating at 900 r.p.m. about its axis. When the power is cut-off, it comes to rest in 1 minute. The angular retardation in radian/s^2 is

(A) $\pi/2$ (B) $\pi/4$ (C) $\pi/6$ (D) $\pi/8$

Correct Option: A

Solution:

$$\omega_0 = \frac{900 \times 2\pi}{60} = 30\pi \text{ rad/s}$$

$$\omega = \omega_0 - \alpha t$$

$$\Rightarrow 0 = 30\pi - \alpha(60)$$

$$\Rightarrow \alpha = \frac{30\pi}{60} = \frac{\pi}{2} \text{ rad/s}^2$$

40. The upper half of an inclined plane with inclination ϕ perfectly smooth while the lower half is rough. A block starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half given by

(A) $2 \cos \phi$ (B) $2 \tan \phi$
(C) $2 \sin \phi$ (D) $\tan \phi$

Correct Option: B

Solution:

(d) Acceleration of block while sliding down upper half = $g \sin \phi$;

retardation of block while sliding down lower half = $(g \sin \phi - \mu g \cos \phi)$

For the block to come to rest at the bottom, acceleration in I half = retardation in II half.

$$g \sin \phi = - (g \sin \phi)$$

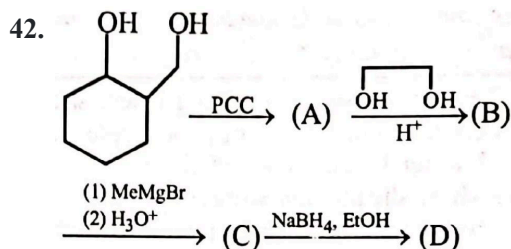
$$\Rightarrow \mu = 2 \tan \phi$$

41. $\Delta_f G^\circ$ vs T plot in the Ellingham diagram slopes downward for the reaction

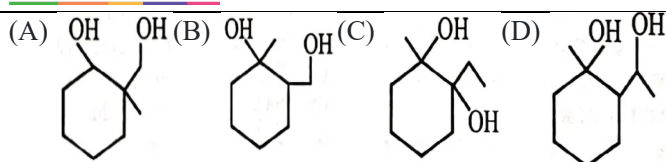
(A) $Mg + \frac{1}{2} O_2 \rightarrow MgO$
(B) $2Ag + \frac{1}{2} O_2 \rightarrow Ag_2O$
(C) $C + \frac{1}{2} O_2 \rightarrow CO$
(D) $CO + \frac{1}{2} O_2 \rightarrow CO_2$

Correct Option: C

Solution:

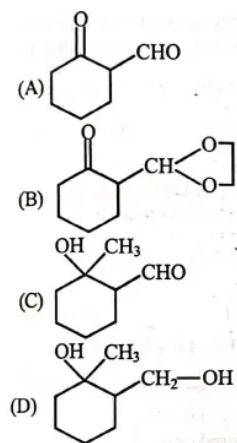


Product (D) in above reaction is:



Correct Option: B

Solution:

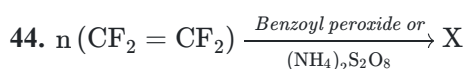


43. Select the incorrect statement.

- (A) Equanil is used to control depression and hypertension.
 (B) Mifepristone is a synthetic steroid used as "morning after pill".
 (C) 0.2 per cent solution of phenol is an antiseptic while its 1.0 per cent solution is a disinfectant.
 (D) A drug which kills the organism in the body is called bacteriostatic.

Correct Option: D

Solution:



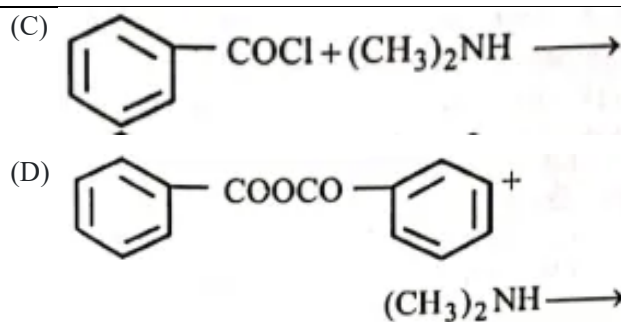
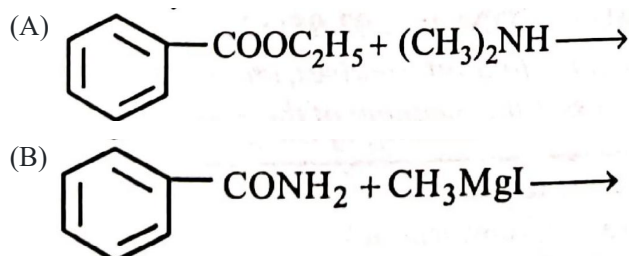
Here, X is :

- (A) RMMA (B) PVC
 (C) PAN (D) None of these

Correct Option: D

Solution:

45. Which of the following reactions will not give N, N - dimethyl benzamide ?



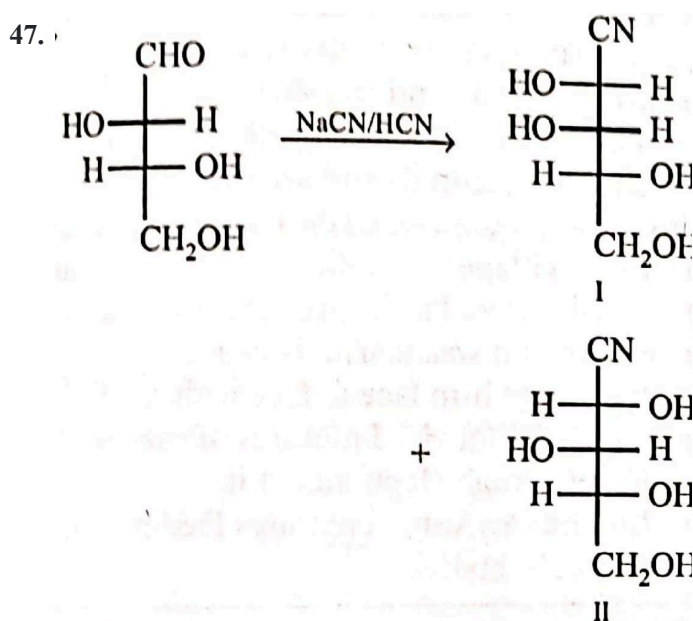
Correct Option: B

Solution:

46. Which is not the correct statement?
 (At. nos. Ce = 58, Lu = 71, La = 57, Yb = 70)
 (A) Colour of Yb^{3+} ion is pink.
 (B) La^{3+} is diamagnetic.
 (C) Ce^{4+} has f^0 configuration.
 (D) Lu^{3+} had f^{14} configuration.

Correct Option: A

Solution:



Compounds I and II may be grouped as

- (A) diastereomers (B) epimers
 (C) C-2 epimers (D) all of the three

Correct Option: D

Solution:

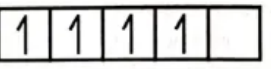
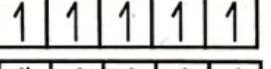
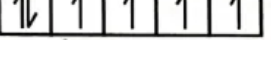
48. The d-electron configurations of Cr^{2+} , Mn^{2+} , Fe^{2+} and Co^{2+} are d^4 , d^5 , d^6 and d^7 respectively. Which one of the following will exhibit the lowest paramagnetic behaviour?
 (Atomic no. Cr = 24, Mn = 25, Fe = 26, Co = 27)

- (A) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
 (B) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
 (C) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
 (D) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

Correct Option: A

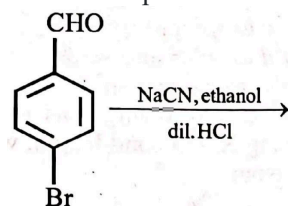
Solution:

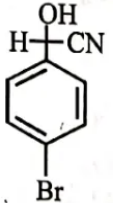
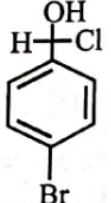
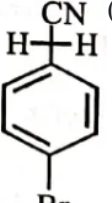
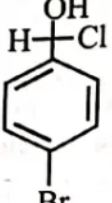
Electronic configuration | No. of unpaired electrons

Co^{2+}	d^7		3
Cr^{2+}	d^4		4
Mn^{2+}	d^5		5
Fe^{2+}	d^6		4

$\therefore$ Since Co^{2+} has lowest no. of unpaired electrons hence lowest paramagnetic behaviour is shown by $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$

49. What is the product of the following reaction?

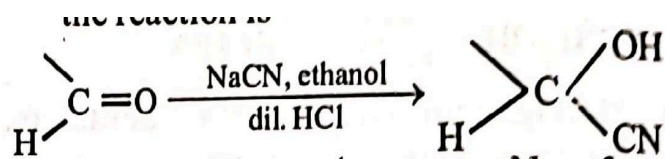


- (A)  (B)  (C)  (D) 

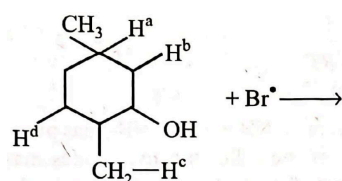
Correct Option: A

Solution:

(a) Only-CHO group reacts with CN^- ion and the reaction is



50.



$\text{Br}^\bullet$ will abstract which of the hydrogen most readily?

- (A) a (B) b (C) c (D) d

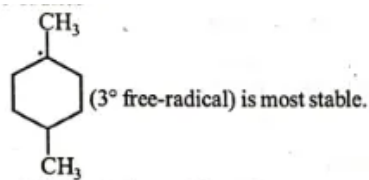
Correct Option: A

Solution:

(a) Bromine is more selective

$\therefore$ abstract that hydrogen which forms stable free-radical

$\therefore$



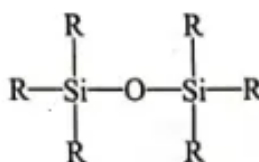
51. Identify the incorrect statement :

- (A) In $(\text{Si}_3\text{O}_9)^{6-}$, tetrahedral SiO_4 units share two oxygen atoms.
 (B) Trialkylchlorosilane on hydrolysis gives R_3SiOH .
 (C) SiCl_4 undergoes hydrolysis to give H_4SiO_4 .
 (D) $(\text{Si}_3\text{O}_9)^{6-}$ has cyclic structure.

Correct Option: B

Solution:

The hydrolysis of Trialkylchlorosilane R_3SiCl yields dimer :



52. Two vessels of volumes 16.4 L and 5 L contain two ideal gases of molecular existence at the respective temperatures of 27°C and 227°C and exert 1.5 and 4.1 atmospheres respectively. The ratio of the number of molecules of the former to that of the latter is

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

Correct Option: A

Solution:

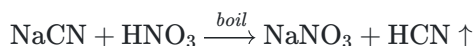
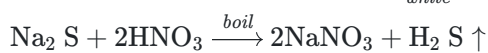
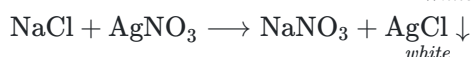
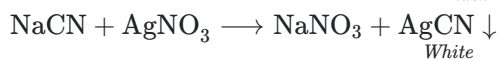
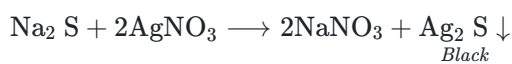
53. The Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens because

- (A) silver halides are soluble in HNO_3
 (B) Na_2S and NaCN are decomposed by HNO_3
 (C) Ag_2S is soluble in HNO_3

(D) AgCN is soluble in HNO₃

Correct Option: B

Solution:



54. A radioactive isotope having a half-life period of 3 days was received after 12 days. If 3 g of the isotope is left in the container, what would be the initial mass of the isotope?

(A) 12 g (B) 36 g (C) 48 g (D) 24 g

Correct Option: C

Solution:

Given $t_{1/2} = 3$

Total time $T = 12$

No. of half lives (n) = $\frac{12}{3} = 4$

$$\left(\frac{1}{2}\right)^n = \frac{N}{N_0} \quad \therefore \left(\frac{1}{2}\right)^4 = \frac{3}{N}$$

$$\frac{3}{N} = \frac{1}{16}$$

$$N = 48 \text{ g}$$

55. An organic compound with the formula C₆H₁₂O₆ forms a yellow crystalline solid with phenylhydrazine and gives a mixture of sorbitol and mannitol when reduced with sodium. Which among the following could be the compound?

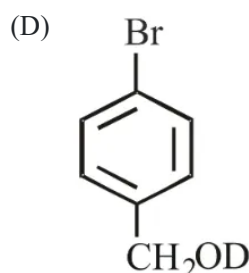
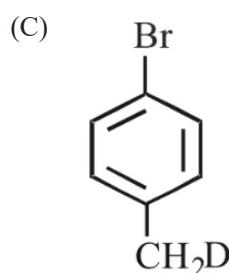
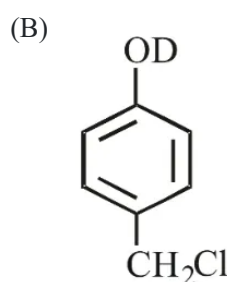
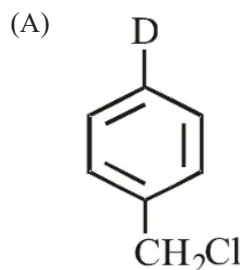
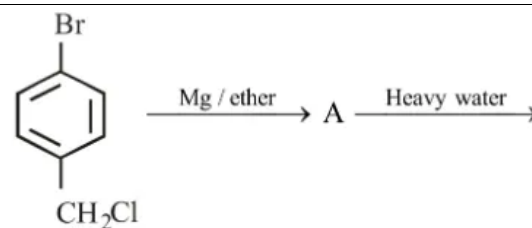
(A) fructose (B) glucose (C) mannose (D) sucrose

Correct Option: A

Solution:

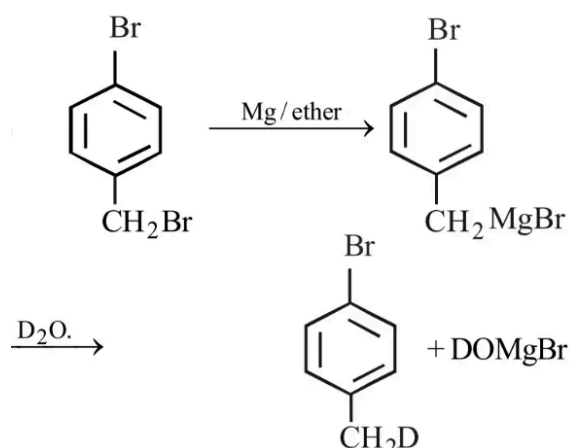
Since the compound forms a yellow crystalline solid, i.e. osazone with phenylhydrazine, it may be an aldohexose or a ketohexose. Further, since on reduction, compound forms a mixture of sorbitol and mannitol, it must be a ketohexose, i.e. fructose. Recall that glucose on reduction gives only one alcohol glucitol (Sorbitol)

56. The final product obtained in the reaction



Correct Option: C

Solution:



57. Methylene blue, from its aqueous solution, is adsorbed on activated charcoal at 25°C . For this process, which of the following statement is correct?

- (A) The adsorption requires activation at 25°C
- (B) The adsorption is accompanied by a decrease in enthalpy
- (C) The adsorption increases with increase of temperature
- (D) The adsorption is irreversible

Correct Option: B

Solution:

(b) The adsorption of methylene blue on activated charcoal is an example of physisorption which is exothermic, multilayer and does not have energy barrier.

58. The greenhouse effect is because of the

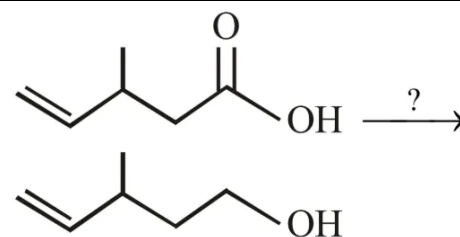
- (A) presence of gases, which in general are strong infrared absorbers, in the atmosphere
- (B) presence of CO_2 only in the atmosphere
- (C) pressure of O_3 and CH_4 in the atmosphere
- (D) N_2O and chlorofluorohydrocarbons in the atmosphere

Correct Option: A

Solution:

Green house gases such as CO_2 , ozone, methane, the chlorofluorocarbon compounds and water vapour form a thick cover around the earth which prevents the IR rays emitted by the earth to escape. It gradually leads to increase in temperature of atmosphere.

59. The following change can be carried out with



- (A) NaBH_4
- (B) LiAlH_4
- (C) H_2/Pt
- (D) $\text{PCC}/\text{CH}_2\text{Cl}_2$

Correct Option: B

Solution:

(b) LiAlH_4 will give the desired compound.

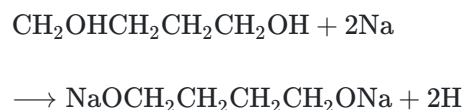
60. On reaction with sodium, 1 mol of a compound X gives mol of H_2 . Which one of the following compounds might be X?

- (A) $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- (B) $\text{CH}_3\text{COOCH}_2\text{CH}_3$
- (C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- (D) $\text{CH}_2(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

Correct Option: D

Solution:

Since 1 mole of compound X reacts with Na to evolve 1 mole of H_2 gas, therefore the compound should have 2 active hydrogen atoms per mole which is possible only in option d.



61. The vapour pressure of two pure liquids A and B that form an ideal solution, are 400 and 800 mm of Hg respectively at a temperature $t^\circ\text{C}$. The mole fraction of A in solution of A and B whose boiling point is $t^\circ\text{C}$ will be

- (A) 0.4
- (B) 0.8
- (C) 0.1
- (D) 0.2

Correct Option: C

Solution:

V.P. of solution at $t^\circ\text{C} = 760 \text{ mm}$

[at b.p., V.P. of solution = atmospheric pressure]

$$\text{Thus } = P_A^\circ \cdot x_A + P_B^\circ \cdot x_B$$

$$\text{or } P = P_A^\circ \cdot x_A + P_B^\circ \cdot (1 - x_A) \quad [\because x_A + x_B = 1]$$

$$\text{or } 760 = 400x_A + 800(1 - x_A) \quad [\because P = 760 \text{ mm of Hg}]$$

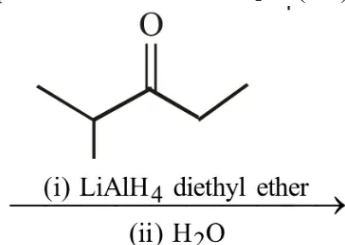
$$\text{or } -800 + 760 = -400x_A$$

$$\text{or } -40 = -400x_A$$

$$\text{or } x_A = \frac{40}{400} = 0.1$$

Thus mole fraction in solution is 0.1

62. The alcohol product(s) of the reduction of 2-methyl-3-pentanone with LiAlH_4 is (are)



- (A) a single enantiomer (B) racemic mixture
(C) two diastereoisomers (D) two structural isomers

Correct Option: B

Solution:

The resulting compound is $\text{C}_3\text{H}_7\text{CH}(\text{OH})\text{C}_2\text{H}_5$ which is optically inactive and reaction leads the racemisation

63. BeF_2 is soluble in water whereas fluorides of other alkaline earth metals are insoluble because of
- (A) ionic nature of BeF_2 .
(B) covalent nature of BeF_2 .
(C) greater hydration energy of Be^{2+} ion as compared to its lattice energy.
(D) none of these.

Correct Option: C

Solution:

Be^{2+} being small in size is heavily hydrated and heat of hydration exceeds the lattice energy.

Hence BeF_2 is soluble in water.

64. The amount of H_2O_2 present in 1 litre of $1.5\text{NH}_2\text{O}_2$ solution, is :
- (A) 25.5 g (B) 3.0 g (C) 8.0 g (D) 2.5 g

Correct Option: A

Solution:

Molecular weight of $\text{H}_2\text{O}_2 = 34$

Equivalent weight of $\text{H}_2\text{O}_2 = 17$

$\therefore 1 \text{ L of } 1 \text{ NH}_2\text{O}_2 \text{ has } = 17 \text{ g of } \text{H}_2\text{O}_2$

$\therefore 1 \text{ L of } 1.5\text{NH}_2\text{O}_2 \text{ has } = 1.5 \times 17 = 25.5 \text{ g of } \text{H}_2\text{O}_2$

65. Which of the following is not a disproportionation reaction?
- (A) $\text{P}_4 + 5\text{OH}^- \longrightarrow \text{H}_2\text{PO}_2^- + \text{PH}_3$
(B) $\text{Cl}_2 + \text{OH}^- \longrightarrow \text{Cl}^- + \text{ClO}^-$
(C) $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$
(D) $\text{PbO}_2 + \text{H}_2\text{O} \longrightarrow \text{PbO} + \text{H}_2\text{O}_2$

Correct Option: D

Solution:

Disproportionation involves simultaneous oxidation and reduction of the same atom in a molecule.

66. A solution of NH_4Cl and NH_3 has $\text{pH} = 8.0$. Which of the following hydroxides may be precipitated when the solution is mixed with equal volume of 0.2 M of metal ion.
- (A) $\text{Ba}(\text{OH})_2$ ($K_{\text{sp}} = 1.1 \times 10^{-4}$)
(B) $\text{Mg}(\text{OH})_2$ ($K_{\text{sp}} = 3.5 \times 10^{-4}$)
(C) $\text{Fe}(\text{OH})_2$ ($K_{\text{sp}} = 8.1 \times 10^{-16}$)
(D) $\text{Ca}(\text{OH})_2$ ($K_{\text{sp}} = 2.1 \times 10^{-5}$)

Correct Option: C

Solution:

$$\text{pH} = 8, \text{pOH} = 6; [\text{OH}^-] = 10^{-6} \text{ M};$$

$$\text{Ionic product of } \text{Fe}(\text{OH})_2 = 0.2 \times (1 \times 10^{-6})^2 = 2 \times 10^{-13} > K_{\text{sp}} (= 8.1 \times 10^{-16})$$

67. Phosphine is not obtained by which of the following reaction?
- (A) White P is heated with NaOH .
(B) Red P is heated with NaOH .
(C) Ca_3P_2 reacts with water.
(D) Both (a) and (c).

Correct Option: B

Solution:

Red P does not react with NaOH to give PH_3 .

68. In a monoclinic unit cell, the relation of sides and angles are respectively:

- (A) $a = b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$
 (B) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$
 (C) $a \neq b \neq c$ and $\beta = \gamma = 90^\circ \neq \alpha$
 (D) $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90^\circ$

Correct Option: C

Solution:

69. For which one of the processes represented by the following equations the enthalpy (heat) change is likely to be negative?

- (A) $\text{Cl}^-(\text{g}) + \text{aq} \rightarrow \text{Cl}^-(\text{aq})$
 (B) $\text{Cl}(\text{g}) \rightarrow \text{Cl}^+(\text{g}) + \text{e}^-$
 (C) $\frac{1}{2}\text{Cl}_2(\text{g}) \rightarrow \text{Cl}(\text{g})$
 (D) $\text{Cl}_2(\text{l}) \rightarrow \text{Cl}_2(\text{g})$

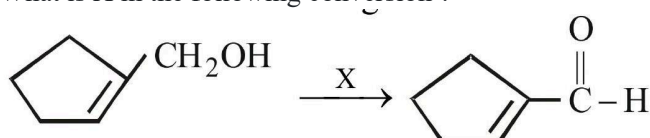
Correct Option: A

Solution:

Gaseous ions, when dissolved in water, get hydrated and heat is evolved (heat of hydration).

$\text{Cl}^-(\text{g}) + \text{aq} \rightarrow \text{Cl}^-(\text{aq})$ is such a reaction.

70. What is X in the following conversion ?

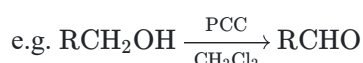


- (A) $\text{K}_2\text{Cr}_2\text{O}_7, \text{H}_2\text{SO}_4/\text{H}_2\text{O}$
 (B) HIO_4
 (C) $\text{PCC}/\text{CH}_2\text{Cl}_2$
 (D) $\text{OsO}_4, (\text{CH}_3)_3\text{C}.\text{COOH}, (\text{CH}_3)_3\text{COH}, \text{OH}$

Correct Option: C

Solution:

Pyridinium chloro chromate selectively oxidises a primary alcohol to an aldehyde



71. The correct order of acidic strength is :

- (A) $\text{Cl}_2\text{O}_7 > \text{SO}_3 > \text{P}_4\text{O}_{10}$

(B) $\text{CO}_2 > \text{N}_2\text{O}_5 > \text{SO}_3$

(C) $\text{Na}_2\text{O} > \text{MgO} > \text{Al}_2\text{O}_3$

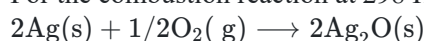
(D) $\text{K}_2\text{O} > \text{CaO} > \text{MgO}$

Correct Option: A

Solution:

As non-metallic character of element attached to oxygen atom increases, the difference between the electronegativity values of element and oxygen decreases and the acid character of oxides increases and vice-versa.

72. For the combustion reaction at 298 K



Which of the following alternatives is correct?

- (A) $\Delta H = \Delta U$
 (B) $\Delta H > \Delta U$
 (C) $\Delta H < \Delta U$
 (D) ΔH and ΔU bear no relation with each other

Correct Option: C

Solution:

$$\Delta H = \Delta U + \Delta nRT$$

$$\Delta n = n_P - n_R$$

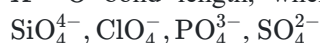
$$\therefore \Delta n = 2 - \frac{5}{2} = -\frac{1}{2}$$

$$\therefore \Delta H = \Delta U - \frac{1}{2}RT$$

$$\therefore \Delta U = \Delta H + \frac{1}{2}RT$$

$$\text{or } \therefore \Delta U > \Delta H$$

73. Arrange the following ions in the order of decreasing X - O bond length, where X is the central atom :

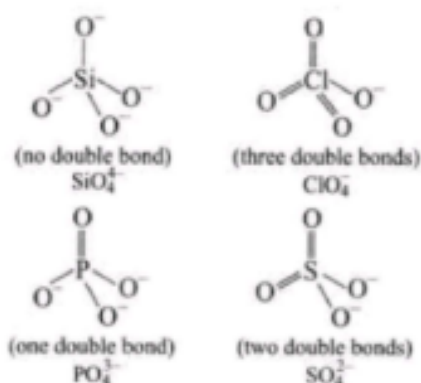


- (A) $\text{ClO}_4^-, \text{PO}_4^{3-}, \text{SO}_4^{2-}, \text{SiO}_4^{4-}$
 (B) $\text{SiO}_4^{4-}, \text{PO}_4^{3-}, \text{SO}_4^{2-}, \text{ClO}_4^-$
 (C) $\text{SiO}_4^{4-}, \text{PO}_4^{3-}, \text{ClO}_4^-, \text{SO}_4^{2-}$
 (D) $\text{SiO}_4^{4-}, \text{SO}_4^{2-}, \text{PO}_4^{3-}, \text{ClO}_4^-$

Correct Option: B

Solution:

The bond length of single bond > Double bond > Triple bond. single bond, longer than double and triple bond



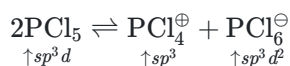
So, the correct order is $\text{SiO}_4^{4-} > \text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{ClO}_4^-$

74. In the reaction $2\text{PCl}_5 \rightleftharpoons \text{PCl}_4^+ + \text{PCl}_6^-$, the change in hybridisation is from

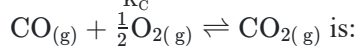
- (A) sp^3d to sp^3 and sp^3d^2
 (B) sp^3d to sp^2 and sp^3
 (C) sp^3d to sp^3d^2 and sp^3d^3
 (D) sp^3d^2 to sp^3 and sp^3d

Correct Option: A

Solution:



75. The ratio $\frac{K_p}{K_c}$ for the reaction:

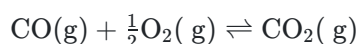


- (A) $(RT)^{1/2}$ (B) RT
 (C) 1 (D) $\frac{1}{\sqrt{RT}}$

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Correct Option: D

Solution:



$$\Delta n_g = 1 - (1 + \frac{1}{2}) = -\frac{1}{2}$$

$$\frac{K_p}{K_c} = (RT)^{\Delta n_g} = \frac{1}{\sqrt{RT}}$$

76. What is the maximum wavelength line in the Lyman series of He^+ ion?

- (A) $3R$ (B) $\frac{1}{3R}$
 (C) $\frac{4}{4R}$ (D) None of these

Correct Option: B

Solution:

$$\frac{1}{\lambda} = RZ^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] = R \times 2^2 \left[\frac{1}{1^2} - \frac{1}{2^2} \right] = 3R$$

$$\therefore \lambda = \frac{1}{3R}$$

77. Maleic acid and fumaric acids are :-

- (A) Tautomers (B) Chain isomers
 (C) Geometrical isomers (D) Functional isomers

Correct Option: C

Solution:

Maleic acid is the cis-isomer (both $-\text{COOH}$ groups are on the same side of the double bond).

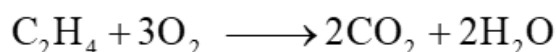
Fumaric acid is the trans-isomer (both $-\text{COOH}$ groups are on the opposite sides of the double bond).

78. An ideal gaseous mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies 28 litre at 1 atm and 273 K. The mixture reacts completely with 128g O_2 to produce CO_2 and H_2O . Mole fraction of C_2H_6 in the mixture is:

- (A) 0.6 (B) 0.4 (C) 0.5 (D) 0.8

Correct Option: B

Solution:



Let vol. of ethane is x,

$$22.4 \times 4 = 3.5x + 3(28 - x)$$

$$\Rightarrow x = 11.2 \text{ litre}$$

at constant T and $P, V \propto n$;

$\therefore$ Mole fraction of C_2H_6 in mixture

$$= \frac{11.2}{28} = 0.4$$

79. If 0.2 gram of an organic compound containing carbon, hydrogen and oxygen on combustion, yielded 0.147 gram carbon dioxide and 0.12 gram water. What will be the content of oxygen in the substance?

(A) 73.29% (B) 78.45% (C) 83.23% (D) 89.50%

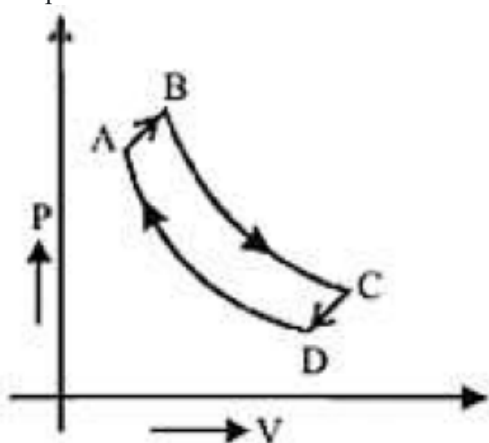
Correct Option: A**Solution:**

$$\% \text{ of C} = \frac{12}{44} \times \frac{0.147}{0.2} \times 100 = 20\%$$

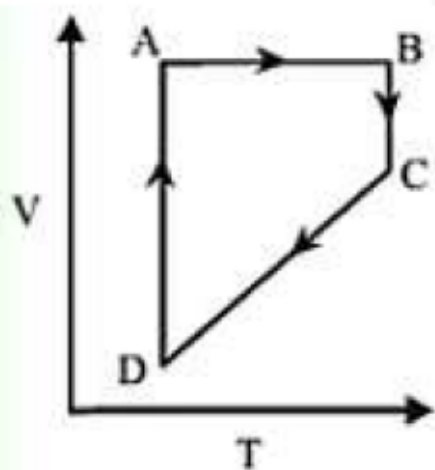
$$\% \text{ of H} = \frac{2}{18} \times \frac{0.12}{0.2} \times 100 = 6.61$$

$$\% \text{ of oxygen} = 100 - (20 + 6.6) = 73.4\%$$

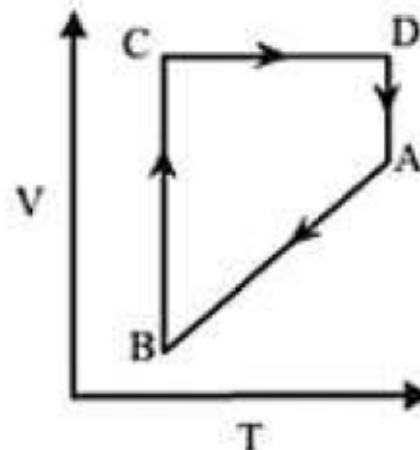
80. A cyclic process ABCD is shown in P – V diagram for an ideal gas. Which of the following diagram represents the same process?



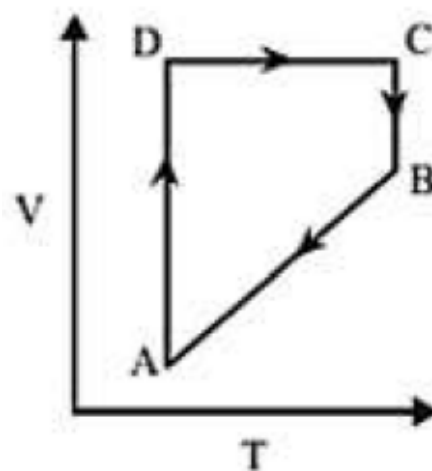
(A)



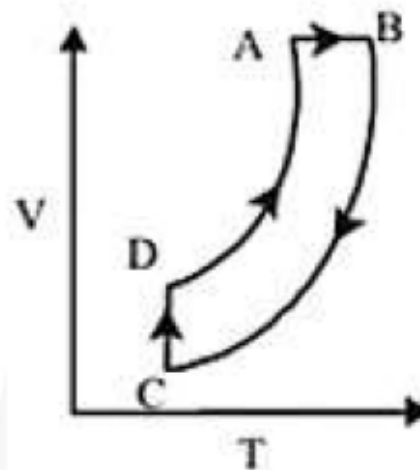
(B)



(C)



(D)

**Correct Option: C****Solution:**

AB : Isobaric expansion

BC : Isothermal expansion

CD : Isochoric

DA : Isothermal compression



81. Subdued

- (A) dim (B) boisterous
(C) solemn (D) crestfallen

Correct Option: B

Solution:

82. Harold's dream was fearful because

- (A) It brought him face to face with reality
(B) It was full of vivid pictures of snakes
(C) He saw huge elephants in it
(D) In it he saw slimy creatures feeding on people's bodies

Correct Option: D

Solution:

83. In his dream, Harold found the loathsome creatures

- (A) in his village (B) in his own house
(C) in a different land (D) in his office

Correct Option: C

Solution:

84. Which one of the following phrases best helps to bring out the precise meaning of 'loathsome creatures'?

- (A) security bug and slimy tentacles
(B) fearful dream and slug-like animals
(C) slimy tentacles and slug-like animals
(D) slug-like animals and security bug

Correct Option: C

Solution:

85. Mother Teresa asked a building where she and her workers could care for the poor people always.

- (A) Mother Teresa asked a building
(B) where she and her workers
(C) could care for the poor people always.
(D) No error

Correct Option: A

Solution:

86. Tryst

- (A) severance (B) rendezvous

(C) annul

(D) disparate

Correct Option: B

Solution:

An agreement (as between lovers) to meet

87. Ignominy

- (A) Exposure (B) Stupidity (C) Disgrace (D) Trial

Correct Option: C

Solution:

Ignominy public shame or disgrace.

88. Onslaught

- (A) Counterattack (B) Resistance
(C) Defense (D) Invasion

Correct Option: D

Solution:

Onslaught a fierce or destructive attack. Invasion an instance of invading a country or region with an armed force.

89. Scrupulous

- (A) Careless (B) Wise (C) Caring (D) Careful

Correct Option: A

Solution:

Scrupulous (of a person or process) diligent, thorough, and extremely attentive to details.

90. Fervent

- (A) Partial (B) Dispassionate
(C) Ardent (D) Decent

Correct Option: B

Solution:

Fervent having or displaying a passionate intensity. Dispassionate not influenced by strong emotion, and so able to be rational and impartial.

91. Harold, a professional man who had worked in an office for many years, had a fearful dream. In it, he found himself in a land where small slug-like animals with slimy tentacles lived on people's bodies. The people tolerated the loathsome creatures because after many years they grew into elephants which then became the nation's system of transport, carrying everyone wherever he wanted to go. Harold suddenly realized that he himself was covered with these things, and he woke up screaming. In a vivid sequence of pictures his dream dramatized for Harold what he had never been able to put into words; he saw himself as letting society feed on his body in his early years so that it would carry him when he retired. He later threw off the 'security bug' and took up freelance work.

The statement that 'he later threw off the security bug' means that

- (A) Harold succeeded in overcoming the need for security.
- (B) Harold stopped giving much importance to dreams.
- (C) Harold started tolerating social victimization.
- (D) Harold killed all the bugs troubling him.

Correct Option: A

Solution:

Harold succeeded in overcoming the need for security.

92. The parents decided it was worth the risk because these children would have succumbed their disease before adulthood.
- (A) The parents decided it was worth the risk
 - (B) because these children would have succumbed their
 - (C) disease before adulthood
 - (D) No error

Correct Option: B

Solution:

Use preposition 'to' after 'succumbed'. Verb 'Succumb' is characterized by preposition 'to'. Moreover, 'Succumb to something' is an idiomatic expression which means to yield to something, especially a temptation, fatal disease, a human weakness, etc.

93. You may not realize it but the weather in Barbados during Christmas is like New York in June.
- (A) You may not realize it
 - (B) but the weather in Barbados during Christmas
 - (C) is like New York in June.

(D) No error

Correct Option: C

Solution:

Write 'that in' after 'like'.

94. The top-ranking manager ____ his success in the profession to his managing director's guidance.
- (A) accounts
 - (B) attributes
 - (C) agrees
 - (D) consider

Correct Option: B

Solution:

Attributes means regard something as being caused by.

95. One of them would keep a look-out on the road behind warn us ____ approaching vehicles.
- (A) for
 - (B) of
 - (C) against
 - (D) with

Correct Option: B

Solution:

Warn a person of possible danger or a potential problem.

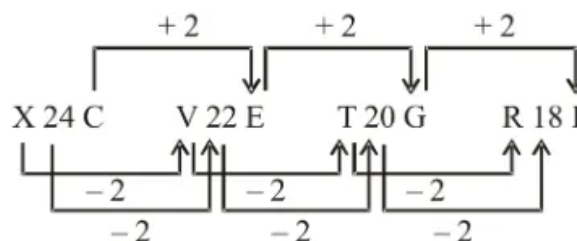
Warn a person against a fault.

Hence out of all four prepositions in options, 'of' is the correct choice.

96. Find the next term in the following series: X24C, V22E, T20G, ____
- (A) RI19
 - (B) R19I
 - (C) R18I
 - (D) RI18

Correct Option: C

Solution:

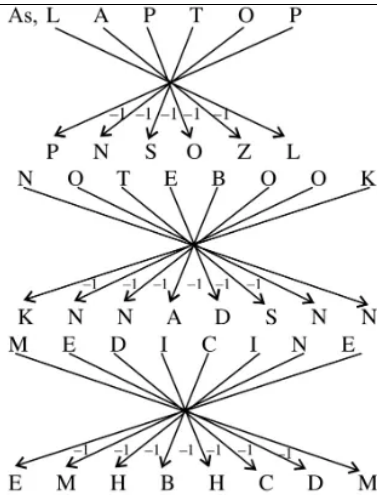


97. If in a code language, LAPTOP is written as PNSOZ and NOTEBOOK and KNNADSNN, then which letter will be there in first and seventh letter from left after coding MEDICINE in the same way?

- (A) ED
- (B) BD
- (C) HM
- (D) DM

Correct Option: A

Solution:



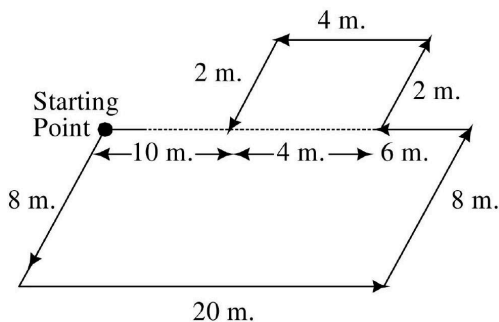
So, required answer = ED

98. Ganesh cycles towards South-West a distance of 8 m. Then he moves towards East a distance of 20 m. From there he moves towards North-East a distance of 8 m, then he moves towards West a distance of 6 m. From there he moves towards North-East a distance of 2 m. Then he moves towards West a distance of 4 m and then towards South-West 2 m and stops at that point. How far is he from the starting point?

(A) 12 m. (B) 10 m. (C) 8 m. (D) 6 m.

Correct Option: B

Solution:

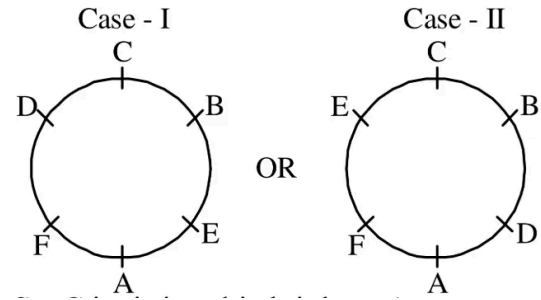


Ganesh is **10 m** far from the starting point

99. Six friends-A, B, C, D, E and F are sitting in a circle facing center. F is to the immediate left of A and B is sitting opposite to F, E and D are sitting opposite to each other. Who is sitting third right to A?
- (A) F (B) E (C) C (D) A

Correct Option: C

Solution:



So, C is sitting third right to A

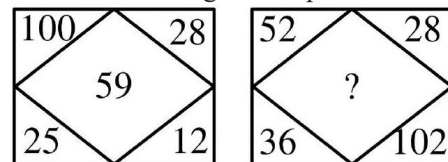
100. A clock with only dot markings 3, 6, 9 and 12 positions has been kept upside down in front of a mirror. A person reads the time in the reflections of the clock as 12 : 30. The actual time that will be
- (A) 12 O'clock (B) 12 : 30
(C) 6 O'clock (D) 03 : 45

Correct Option: C

Solution:

In this time 12 : 30 we subtract that time from 17 : 90 —
 $12 : 30 = 5 : 60 = 6 : 00$

101. In each of the following question select the missing number from the given responses..



(A) 50 (B) 90 (C) 218 (D) 64

Correct Option: B

Solution:

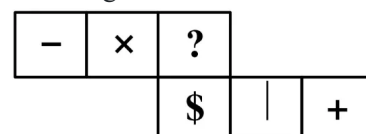
$$(100+12)-(28+25)=59$$

Similarly,

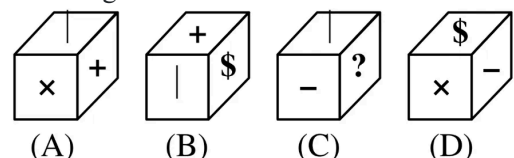
$$(102+52)-(36+28)=90$$

102. From the answer figure choose the box that is similar to the box formed by folding the question figure.

Question figure:



Answer figures:



(A) 1 and 2 only

(B) 2, 3 and 4 only

(C) 4 only

(D) 3 and 4 only

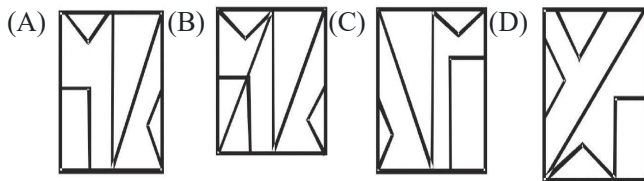
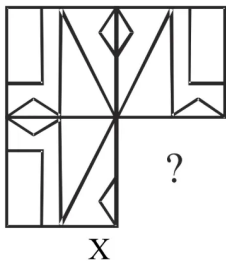
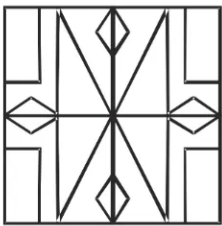
Correct Option: C**Solution:**

Front Face	-	'	\$
Opposite Face	?	.	+

Only cube (4) can be formed.

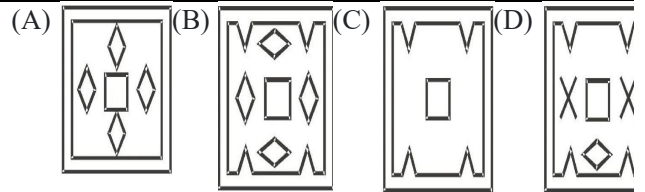
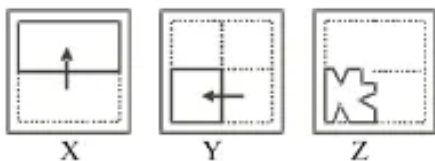
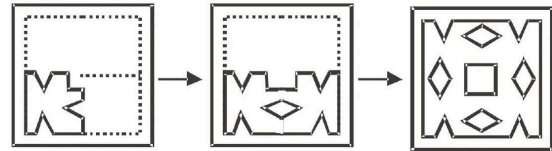
103. Which answer figure complete the form in question figure ?

Question Figure:

**Correct Option: C****Solution:**

104. In the following questions a piece of paper is folded and punched as shown in problem figures and four answer figure marked (a), (b), (c), (d) are given. Select the answer figure which indicates how the paper will appear when open (unfolded).

Question Figure:

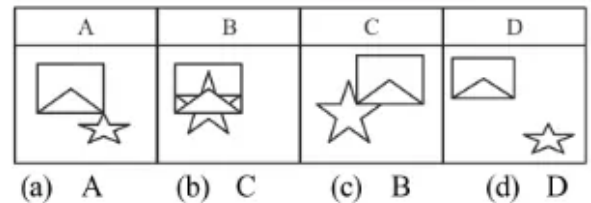
**Correct Option: B****Solution:**

105. Which of the option figures bears the closest resemblance to the question figure?

Question Figure:



Option Figures:



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

Correct Option: B**Solution:**

Closest Resemblance is mirror image of question figure.

106. Let f be the function defined by

$$f(x) = \begin{cases} \frac{x^2-1}{x^2-2|x-1|-1}, & x \neq 1 \\ 1/2, & x = 1 \end{cases}$$

- (A) The function is continuous for all values of x
 (B) The function is continuous only for $x > 1$
 (C) The function is continuous at $x = 1$
 (D) The function is not continuous at $x = 1$

Correct Option: D**Solution:**

107. If a, c, b are in G.P., then the area of the triangle formed by the line $ax + by + c = 0$ with the coordinate axes is equal to

- (A) 1 (B) 2

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

(D) None of these

Correct Option: C**Solution:**

108. Suppose $p, q, r \neq 0$ and the system of equations $(p + a)x + by + cz = 0$, $ax + (q + b)y + cz = 0$, $ax + by + (r + c)z = 0$ has a non-trivial solution, then value of $\frac{a}{p} + \frac{b}{q} + \frac{c}{r}$ is

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

Correct Option: A**Solution:**

109. The solutions of $(x + y + 1)dy = dx$ are

(A) $x + y + 2 = Ce^y$ (B) $x + y + 4 = C \log y$
 (C) $\log(x + y + 2) = Cy$ (D) $\log(x + y + 2) = C - y$

Correct Option: A**Solution:**

110. The number of real solutions of the equation $(x - 1)^2 + (x - 2)^2 + (x - 3)^2 = 0$ is

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

Correct Option: C**Solution:**

111. A student read common difference of an A.P. as -2 instead of 2 and got the sum of first 5 terms as -5. Actual sum of first five terms is

(A) 25 (B) -25 (C) -35 (D) 35

Correct Option: D**Solution:**

112. $\int_{\pi/3}^{\pi/2} x \sin(\pi[x] - x) dx$ is equal to:

(A) $\frac{1}{2} + \frac{\pi}{6}$
 (B) $1 - \frac{\sqrt{3}}{2} + \frac{\pi}{6}$
 (C) $-\frac{1}{2} - \frac{\pi}{6}$
 (D) $\frac{\sqrt{3}}{2} - 1 - \frac{\pi}{6}$

Correct Option: B**Solution:**

113. The length of the latus rectum of the parabola which has focus at $(-1, 1)$ and the directrix is $4x + 3y - 24 = 0$ is

(A) 4 (B) 6 (C) 8 (D) 10

Correct Option: D**Solution:**

114. Let $x + y = 3 - \cos 4\theta$ and $x - y = 4 \sin 2\theta$ then the greatest of xy is

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

Correct Option: B**Solution:**

115. The probability that certain electronic component fails when first used is 0.10. If it does not fail immediately, the probability that it lasts for one year is 0.99. The probability that a new component will last for one year is

(A) 0.99 (B) 0.871 (C) 0.891 (D) 0.762

Correct Option: C**Solution:**

116. If $xy + y^2 = \tan x + y$, then find $\frac{dy}{dx}$ is

(A) $\frac{\sec^2 x}{x+2y}$
 (B) $\frac{\sec^2 x-y}{(x+2y-1)}$
 (C) $(x+2y-1) \sec^2 x$
 (D) $\sec^2 x \cdot y$

Correct Option: B**Solution:**

117. A straight rod of length 9 units slides with its ends A, B always on the X and Y-axis respectively. Then the locus of the centroid of $\triangle OAB$ is :

(A) $x^2 + y^2 = 3$ (B) $x^2 + y^2 = 9$
 (C) $x^2 + y^2 = 1$ (D) $x^2 + y^2 = 81$

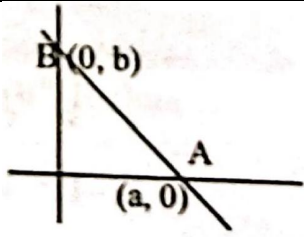
Correct Option: B**Solution:**Let end A be $(a, 0)$

and end B is

 $(0, b)$ then

$$a^2 + b^2 = 81 \dots (1)$$

If centroid is (x, y) then



$x = \frac{a}{3}$, $y = \frac{b}{3}$, putting in (1) we get the locus as

$$x^2 + y^2 = 9$$

118. Consider the function $f(x) = |x - 1|x^2$, then $f(x)$ is

- (A) increasing in $(0, 1) \cup (2, \infty)$
- (B) increasing in $(-\infty, 0) \cup (1, 2)$
- (C) decreasing in $(0, 1) \cup (2, \infty)$
- (D) decreasing in $(0, 1) \cup (2, \infty)$

Correct Option: D

Solution:

119. The solution of the differential equation

$$(x + 1) \frac{dy}{dx} - y = e^{3x}(x + 1)^2 \text{ is}$$

- (A) $y = (x + 1)e^{3x} + c$
- (B) $3y = (x + 1) + e^{3x} + c$
- (C) $\frac{3y}{x+1} = e^{3x} + c$
- (D) $ye^{-3x} = 3(x + 1) + c$

Correct Option: C

Solution:

120. The sum of the infinite series $\frac{2^2}{2!} + \frac{2^4}{4!} + \frac{2^6}{6!} + \dots$ is equal to

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

Correct Option: C

Solution:

121. The number of possible outcomes in a throw of n ordinary dice in which at least one of the dice shows an odd number is

- (A) $6^n - 1$
- (B) $3^n - 1$
- (C) $6^n - 3^n$
- (D) None of these

Correct Option: C

Solution:

122. The value of $\sin \left[n\pi + (-1)^{\frac{n\pi}{4}} \right]$, $n \in \mathbb{I}$ is

- (A) 0
- (B) $\frac{1}{\sqrt{2}}$
- (C) $-\frac{1}{\sqrt{2}}$
- (D) None of these

Correct Option: B

Solution:

123. The domain of the function

$$f(x) = \sqrt{x - \sqrt{1 - x^2}} \text{ is}$$

- (A) $\left[-1, -\frac{1}{\sqrt{2}}\right] \cup \left[\frac{1}{\sqrt{2}}, 1\right]$
- (B) $[-1, 1]$
- (C) $(-\infty, -\frac{1}{2}] \cup [\frac{1}{\sqrt{2}}, +\infty)$
- (D) $\left[\frac{1}{\sqrt{2}}, 1\right]$

Correct Option: D

Solution:

124. $\int_0^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)}$ is

- (A) $\frac{\pi ab}{a+b}$
- (B) $\frac{\pi}{2(a+b)}$
- (C) $\frac{\pi}{2ab(a+b)}$
- (D) $\frac{\pi(a+b)}{2ab}$

Correct Option: C

Solution:

125. If a chord of the circle $x^2 + y^2 = 8$ makes equal intercepts of length a on the coordinate axes, then

- (A) $|a| < 8$
- (B) $|a| < 4\sqrt{2}$
- (C) $|a| < 4$
- (D) $|a| > 4$

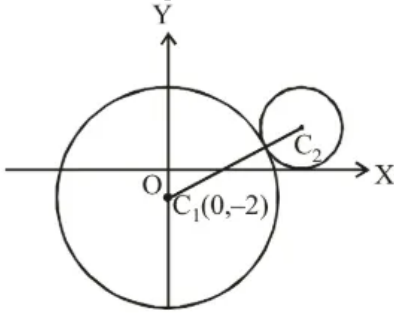
Correct Option: C

Solution:

Since the chord makes equal intercepts of length a on the coordinate axes. So, its equation can be written as $x \pm y = \pm a$. This line meets the given circle at two distinct points. So, length of the perpendicular from the centre $(0, 0)$ of the given circle must be less than the radius.

$$\text{i.e. } \left| \pm \frac{a}{\sqrt{2}} \right| < \sqrt{8} \Rightarrow a^2 < 16 \Rightarrow |a| < 4$$

126. In the given figure, the equation of the larger circle is $x^2 + y^2 + 4y - 5 = 0$ and the distance between centres is 4. Then the equation of smaller circle is



- (A) $(x - \sqrt{7})^2 + (y - 1)^2 = 1$ (B) $(x + \sqrt{7})^2 + (y - 1)^2 = 1$
 (C) $x^2 + y^2 = 2\sqrt{7}x + 2y$ (D) None of these

Correct Option: A

Solution:

We have $x^2 + y^2 + 4y - 5 = 0$. Its centre is $C_1(0, -2)$,

$r_1 = \sqrt{4 + 5} = 3$. Let $C_2(h, k)$ be the centre of the

smaller circle and its radius r_2 . Then $C_1C_2 = 4$.

$$\Rightarrow \sqrt{h^2 + (k + 2)^2} = 3 + r_2 = 4 \quad \dots\dots(1)$$

$$\Rightarrow r_2 = 1$$

But $k = r_2 = 1$

[it touches x-axis]

$$\therefore \text{From eq (1), } 4 = \sqrt{h^2 + (1 + 2)^2}$$

$$\Rightarrow 16 = h^2 + 9 \Rightarrow h^2 = 7 \Rightarrow h = \pm\sqrt{7}$$

Since $h > 0 \therefore h = \sqrt{7}$

Hence, required circle is

$$(x - \sqrt{7})^2 + (y - 1)^2 = 1$$

127. Let $[x]$ denote the greatest integer $\leq x$. If $f(x) = [x]$ and $g(x) = |x|$, then the value of $f(g(\frac{8}{5})) - g(f(-\frac{8}{5}))$ is

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

Correct Option: D

Solution:

Given that, $f(x) = [x]$ and

$$g(x) = |x|$$

$$\text{Now, } f(g(\frac{8}{5})) = g(\frac{8}{5}) = [\frac{8}{5}] = 1$$

$$\text{and } g(f(-\frac{8}{5})) = g([- \frac{8}{5}]) = g(-2) = |-2| = 2$$

$$\therefore f(g(\frac{8}{5})) - g(f(-\frac{8}{5})) = 1 - 2 = -1.$$

128. The equation $\sin^4 x - (k + 2)\sin^2 x - (k + 3) = 0$ possesses a solution if

- (A) $k > -3$ (B) $k < -2$
 (C) $-3 \leq k \leq -2$ (D) k is any positive integer

Correct Option: C

Solution:

We have,

$$\sin^4 x - (k + 2)\sin^2 x - (k + 3) = 0$$

$$\Rightarrow \sin^2 x = \frac{(k + 2) \pm \sqrt{(k + 2)^2 + 4(k + 3)}}{2}$$

$$= \frac{(k + 2) \pm (k + 4)}{2}$$

$$\Rightarrow \sin^2 x = k + 3 (\because \sin^2 x = -1 \text{ is not possible})$$

Since $0 \leq \sin^2 x \leq 1$,

$$\therefore 0 \leq k + 3 \leq 1 \text{ or } -3 \leq k \leq -2$$

129. If 16 identical pencils are distributed among 4 children such that each gets at least 3 pencils.

The number of ways of distributing the pencils is

- (A) 15 (B) 25 (C) 35 (D) 40

Correct Option: C

Solution:

Required number of ways

$$= \text{coeff. of } x^{16} \text{ in } (x^3 + x^4 + x^5 + x^6 + x^7)^4$$

130. If a, b, c are positive numbers, then least value of $(a + b + c)(\frac{1}{a} + \frac{1}{b} + \frac{1}{c})$ is

- (A) 1 (B) 6 (C) 9 (D) None

Correct Option: C

Solution:

$$AM \geq HM$$

$$\Rightarrow \frac{a+b+c}{3} \geq \frac{3}{\frac{1}{a} + \frac{1}{b} + \frac{1}{c}}$$

$$\Rightarrow (a+b+c) \left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c} \right) \geq 9$$

131. If $\vec{r}$ and $\vec{s}$ are non-zero constant vectors and the scalar b is chosen such that $|\vec{r} + b\vec{s}|$ is minimum, then the value of $|b\vec{s}|^2 + |\vec{r} + b\vec{s}|^2$ is equal to

- (A) $2|\vec{r}|^2$ (B) $|\vec{r}|^2/2$
(C) $3|\vec{r}|^2$ (D) $|\vec{r}|^2$

Correct Option: D

Solution:

For minimum value $|\vec{r} + b\vec{s}| = 0$.

Let $\vec{r}$ and $\vec{s}$ are anti-parallel so $b\vec{s} = -\vec{r}$

$$\therefore |b\vec{s}|^2 + |\vec{r} + b\vec{s}|^2 = |-\vec{r}|^2 + |\vec{r} - \vec{r}|^2 = |\vec{r}|^2.$$

132. Statement-1: If the general equation $x^2 + y^2 + 2xy + 2gx + 2fy + 4 = 0$ represents a pair of real lines then $|g| \geq 2$.

Statement-2 : The equation

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents pair of real lines if $abc + 2fgh - af^2 - bg^2 - ch^2 = 0$.

- (A) Statement-1 is false, Statement-2 is true
(B) Statement-1 is true, Statement-2 is true;
Statement-2 is a correct explanation for Statement-1
(C) Statement-1 is true, Statement-2 is true;
Statement-2 is not a correct explanation for Statement-1
(D) Statement-1 is true, Statement-2 is false

Correct Option: D

Solution:

The equation represents a pair of lines if

$$1 \cdot 1 \cdot 4 + 2 \cdot f \cdot g \cdot 1 - 1 \cdot f^2 - 1 \cdot g^2 - 4 \cdot 1^2 = 0$$

$$\Rightarrow (f - g)^2 = 0 \Rightarrow f = g$$

The equation becomes $(x + y)^2 + 2g(x + y) + 4 = 0$

which represents pair of parallel lines, which are real provided $(2g)^2 - 4 \cdot 4 \cdot 1 \geq 0 \Rightarrow |g| \geq 2$.

133. If $|z_1| = |z_2| = \dots = |z_n| = 1$, then the value of $|z_1 + z_2 + \dots + z_n| - \left| \frac{1}{z_1} + \frac{1}{z_2} + \dots + \frac{1}{z_n} \right|$ is,

- (A) 0 (B) 1 (C) -1 (D) None

Correct Option: A

Solution:

$$z_1 \bar{z}_1 = z_2 \bar{z}_2 = \dots = z_n \bar{z}_n = 1$$

$$\Rightarrow \bar{z}_1 = \frac{1}{z_1}, \bar{z}_2 = \frac{1}{z_2}, \bar{z}_3 = \frac{1}{z_3}, \dots, \bar{z}_n = \frac{1}{z_n}$$

$$\therefore |z_1 + z_2 + \dots + z_n| - \left| \frac{1}{z_1} + \frac{1}{z_2} + \dots + \frac{1}{z_n} \right|$$

$$= |z_1 + z_2 + \dots + z_n| - |\bar{z}_1 + \bar{z}_2 + \dots + \bar{z}_n| = 0$$

134. If the coordinates at one end of a diameter of the circle $x^2 + y^2 - 8x - 4y + c = 0$ are $(-3, 2)$, then the coordinates at the other end are

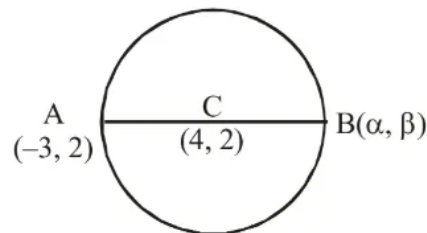
- (A) $(5, 3)$ (B) $(6, 2)$ (C) $(1, -8)$ (D) $(11, 2)$

Correct Option: D

Solution:

The centre of the given circle is $C \equiv (4, 2)$.

Let $A \equiv (-3, 2)$.



If (α, β) are the coordinates of the other end of the diameter, then, as the midpoint of the diameter is the centre,

$$\therefore \frac{\alpha + (-3)}{2} = 4 \text{ and } \frac{\beta + 2}{2} = 2 \Rightarrow \alpha = 11, \beta = 2.$$

Thus, the coordinates of the other end of diameter are $(11, 2)$.

135. Total number of ways of selecting 2 white squares on a normal chess board if the squares are not from the same row or column is equal to

- (A) 480 (B) 496 (C) 412 (D) 400

Correct Option: D

Solution:

2 white squares can be selected in ${}^{32}C_2$ ways. If they belong to some row or same column then $2(8 \cdot {}^4C_2)$ ways.

136. The least positive non-integral solution of the equation $\sin \pi(x^2 + x) = \sin \pi x^2$ is

- (A) rational
 (B) irrational of the form $\sqrt{p}$
 (C) irrational of the form $\frac{\sqrt{p}-1}{4}$, where p is an odd integer
 (D) irrational of the form $\frac{\sqrt{p}+1}{4}$, where p is an even integer

Correct Option: A

Solution:

We have, $\sin \pi (x^2 + x) = \sin \pi x^2$

$$\Rightarrow \pi (x^2 + x) = n\pi + (-1)^n \pi x^2$$

$$\therefore \text{Either } x^2 + x = 2m + x^2 \Rightarrow x = 2m \in \mathbb{I}$$

or $x^2 + x = k - x^2$, where k is an odd integer

$$\Rightarrow 2x^2 + x - k = 0 \Rightarrow x = \frac{-1 \pm \sqrt{1+8k}}{4}$$

For least positive non-integral solution

$$\text{is } x = \frac{1}{2}, \text{ when } k = 1$$

- 137.** ABC is a triangular park with $AB = AC = 100$ m. A TV tower stands at the mid-point of BC. The angles of elevation of the top of the tower at A, B, C are $45^\circ, 60^\circ, 60^\circ$ respectively. The height of the tower is

- (A) 50 m (B) $50\sqrt{3}$ m
 (C) $50\sqrt{2}$ m (D) $50(3 - \sqrt{3})$ m

Correct Option: B

Solution:

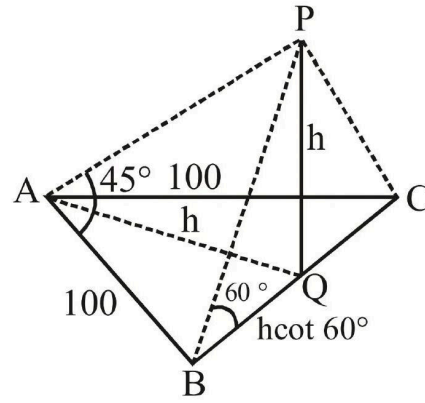
$$(b) \tan 45^\circ = \frac{PQ}{AQ} = \frac{h}{AQ} \Rightarrow h = AQ$$

Where PQ is tower and ABC is the park, with Q

being mid point of the side BC and $PQ = h$

$$\text{Also, } AQ^2 + BQ^2 = 100^2$$

$$\Rightarrow h^2 + h^2 \cot^2 60^\circ = 100^2$$



$$\Rightarrow h^2 [1 + \frac{1}{3}] = 100^2$$

$$\Rightarrow h^2 = \frac{3 \times 100^2}{4} \Rightarrow h = 50\sqrt{3}$$

- 138.** If x, y and z are real numbers, then

$x^2 + 4y^2 + 9z^2 - 6yz - 3zx - 2xy$ is always

- (A) positive (B) non-positive
 (C) zero (D) non-negative

Correct Option: D

Solution:

$$x^2 + 4y^2 + 9z^2 - 6yz - 3zx - 2xy$$

$$= x^2 + (2y)^2 + (3z)^2 - (2y)(3z) - (3z)(x) - x(2y) \geq 0 \forall x, y, z$$

$$[\because a^2 + b^2 + c^2 - ab - bc - ca \geq 0]$$

- 139.** A person invites a party of 10 friends at dinner and places them so that 4 are on one round table and 6 on the other round table. The number of ways in which he can arrange the guests is

- (A) $\frac{(10)!}{6!}$ (B) $\frac{(10)!}{24}$
 (C) $\frac{(9)!}{24}$ (D) None of these

Correct Option: B

Solution:

$$\text{Selection of 6 guests} = {}^{10}C_6$$

$$\text{Permutation of 6 on round table} = 5!$$

$$\text{Permutation of 4 on round table} = 3!$$

$$\text{Then, total number of arrangements} = {}^{10}C_6 \times 5! \times 3!$$

$$= \frac{(10)!}{6!4!} \times 5! \times 3! = \frac{(10)!}{24}$$

140. If $a > 0, b > 0, c > 0$ and a, b, c are distinct, then $(a + b)(b + c)(c + a)$ is greater than

- (A) $2(a + b + c)$ (B) $3(a + b + c)$ (C) $6abc$ (D) $8abc$

Correct Option: D

Solution:

AM > GM

$$\Rightarrow \frac{a+b}{2} > \sqrt{ab}, \frac{b+c}{2} > \sqrt{bc}, \frac{c+a}{2} > \sqrt{ca},$$

$$\text{So, } (a + b)(b + c)(c + a) > 8abc$$

141. The equation of the tangent to the curve $y = be^{-x/a}$ at the point where it crosses the y -axis is

- (A) $\frac{x}{a} - \frac{y}{b} = 1$ (B) $ax + by = 1$
(C) $ax - by = 1$ (D) $\frac{x}{a} + \frac{y}{b} = 1$

Correct Option: D

Solution:

$y = be^{-x/a}$ meets the y -axis at $(0, b)$. Again,

$$\frac{dy}{dx} = be^{-x/a} \left(-\frac{1}{a}\right)$$

$$\text{At } (0, b), \frac{dy}{dx} = be^0 \left(-\frac{1}{a}\right) = -\frac{b}{a}$$

Therefore, required tangent is

$$y - b = -\frac{b}{a}(x - 0) \text{ or } \frac{x}{a} + \frac{y}{b} = 1$$

142. If $y = 3x + 6x^2 + 10x^3 + \dots \infty$, then $\frac{1}{3}y - \frac{1.4}{3^2}y^2 + \frac{1.4.7}{3^2.3}y^3 - \dots \infty$ is equal to

- (A) x (B) $1 - x$ (C) $1 + x$ (D) x^x

Correct Option: A

Solution:

We have $y = 3x + 6x^2 + 10x^3 + \dots$

$$\Rightarrow 1 + y = 1 + 3x + 6x^2 + 10x^3 + \dots$$

$$\Rightarrow 1 + y = (1 - x)^{-3} \Rightarrow 1 - x = (1 + y)^{-1/3}$$

$$\Rightarrow x = 1 - (1 + y)^{-1/3}$$

$$= \frac{1}{3}y - \frac{1.4}{3^2.2}y^2 + \frac{1.4.7}{3^2.3}y^3 - \dots$$

143. Suppose that $f(0) = -3$ and $f'(x) \leq 5$ for all values of x .

Then, the largest value which $f(2)$ can attain is

- (A) 7 (B) 10 (C) 2 (D) 9

Correct Option: A

Solution:

Using LMVT in $[0, 2]$

$$\frac{f(2) - f(0)}{2 - 0} = f'(c), \text{ where } c \in (0, 2)$$

$$\frac{f(2) + 3}{2} \leq 5 \Rightarrow f(2) \leq 7.$$

144. The maximum value of $z = 6x + 8y$ subject to constraints $2x + y \leq 30$, $x + 2y \leq 24$, and $x \geq 0, y \geq 0$ is

- (A) 90 (B) 120 (C) 96 (D) 240

Correct Option: B

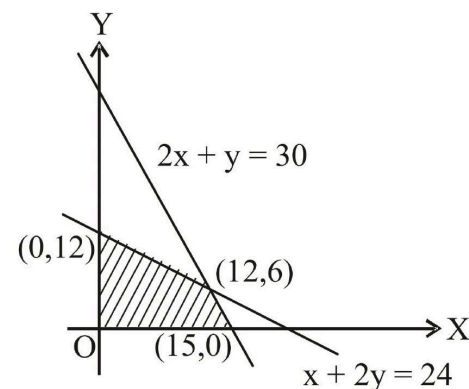
Solution:

Here, $2x + y \leq 30$, $x + 2y \leq 24$, $x, y \geq 0$.

The shaded region represents the feasible region,

hence $z = 6x + 8y$. Obviously it is maximum at $(12, 6)$.

Hence $z = 12 \times 6 + 8 \times 6 = 120$.



145. If a, b, c are three natural numbers in AP and $a + b + c = 21$, then the possible number of values of the ordered triplet (a, b, c) is

- (A) 15 (B) 14
(C) 13 (D) None of these

Correct Option: C

Solution:

Let $a = b - d$ and $c = b + d$, then $a + b + c = 21$

$$\Rightarrow b = 7$$

So, the equation is $a + c = 14$

$$\therefore \text{No. of solution} = \text{coeff. of } x^{14} \text{ in } (x + x^2 + \dots) = {}^{13}C_{12} = 13$$

146. If $\frac{x}{ma} + \frac{y}{nb} = 1$ touches the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then

(A) $m^2 = \frac{n^2}{n^2-1}$ or $n^2 = \frac{m^2}{m^2-1}$

(B) $m^2 = \frac{n^2}{n^2+1}$ or $n^2 = \frac{m^2}{m^2+1}$

(C) $m^2 = \frac{n^2+1}{n^2}$ or $n^2 = \frac{m^2+1}{m^2}$

(D) $m^2 = \frac{n^2-1}{n^2}$ or $n^2 = \frac{m^2-1}{m^2}$

Correct Option: A

Solution:

The line is $y = -\frac{nb}{ma}x - nb$. It will touch

the ellipse if

$$(-nb)^2 = a^2 \left(-\frac{nb}{ma}\right)^2 + b^2$$

$$[c^2 = a^2 m^2 + b^2]$$

$$\Rightarrow n^2 = \frac{n^2}{m^2} + 1$$

$$\Rightarrow m^2 = \frac{n^2}{n^2-1} \text{ or } n^2 = \frac{m^2}{m^2-1}$$

147. The line $y = mx$ bisects the area enclosed by the lines $x = 0$, $y = 0$, and $x = \frac{3}{2}$ and the curve $y = 1 + 4x - x^2$. Then the value of m is

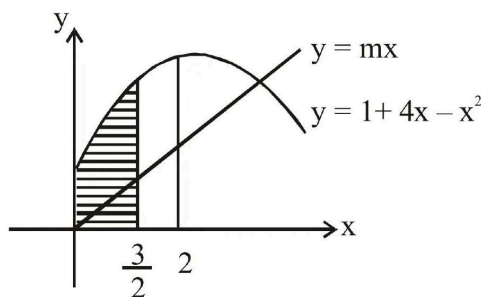
(A) $\frac{13}{6}$ (B) $\frac{13}{2}$

(C) $\frac{13}{5}$ (D) $\frac{13}{7}$

Correct Option: A

Solution:

$$y = 1 + 4x - x^2 = 5 - (x - 2)^2$$



$$\text{We have } \int_0^{3/2} (1 + 4x - x^2) dx = 2 \int_0^{3/2} mx dx$$

$$= \frac{3}{2} + 2 \left(\frac{9}{4}\right) - \frac{1}{3} \left(\frac{27}{8}\right) = m \cdot \frac{9}{4}$$

$$\text{On solving we get } m = \frac{13}{6}$$

148. The distance from the point $(3, 4, 5)$ to the point where the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ meets the plane $x + y + z = 17$ is

(A) 1 (B) 2 (C) 3 (D) $\sqrt{2}$

Correct Option: C

Solution:

Any point on the line is $(r + 3, 2r + 4, 2r + 5)$.

It lies on the plane $x + y + z = 17$,

$$(r + 3) + (2r + 4) + (2r + 5) = 17 \quad \text{i.e. } r = 1$$

Thus, the point of intersection of the plane and the line is $(4, 6, 7)$.

Required distance = distance between $(3, 4, 5)$ and

$(4, 6, 7)$:

$$= \sqrt{(4-3)^2 + (6-4)^2 + (7-5)^2} = 3$$

149. There are four numbers of which the first three are in GP and the last three are in AP, whose common difference is 6. If the first and the last numbers are equal, the two other numbers

(A) $-2, 4$

(B) $-4, 2$

(C) $2, 6$

(D) None of the above

Correct Option: B

Solution:

Let 3 numbers in AP be $a, (a + 6), (a + 12)$.

Also, first and last number out of 4 numbers are equal.

$\therefore$ 4 numbers are $(a + 12), a, (a + 6), (a + 12)$.

Also, given that the first 3 numbers are in GP:

$$\Rightarrow a^2 = (a + 12)(a + 6)$$

$$\Rightarrow a^2 = a^2 + 18a + 72$$

$$\Rightarrow a = -\frac{72}{18} = -4$$

$\therefore$ 4 numbers are $8, -4, 2, 8$.

150. In a statistical investigation of 1003 families of Calcutt it was found that 63 families has neither a radio nor a TV, 794 families has a radio and 187 has TV. The number of families in that group having both a radio and a TV is

(A) 36

(B) 41

(C) 32

(D) None of these

Correct Option: B

Solution:



(b) Given, $n(R) = 794$

$$n(T) = 187$$

$$n(R \cup T)' = 63$$

$$n(Total) = n(R \cup T) + n(R \cup T)'$$

$$\Rightarrow 1003 = n(R \cup T) + 63$$

$$\Rightarrow n(R \cup T) = 940$$

By set theory

$$\Rightarrow n(R \cup T) = n(R) + n(T) - n(R \cap T)$$

$$\Rightarrow 940 = 794 + 187 - n(R \cap T)$$

$$\Rightarrow n(R \cap T) = 981 - 940 = 41$$

BITSAT Solved Paper 2020 - ANSWER KEY

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

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