MHT CET 2020 PCM Oct 15 Shift 1 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2020**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. For any two vectors $\vec{A}$ and $\vec{B}$ if $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$, the magnitude of $(\vec{A} + \vec{B})$ is $\left(\tan \frac{\pi}{4} = 1, \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}}\right)$

(A) $\sqrt{A^2 + B^2 + \sqrt{2}\, AB}$

(B) $\sqrt{A^2 + B^2 + \frac{AB}{\sqrt{2}}}$

(C) $A + B$

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

2. If a vector $A = 2i + 2j + 3k$ and $B = 3i + 6j + nk$ are perpendicular to each other, then the value of n is

(A) $0 \cdot 5$ (B) $-0 \cdot 5$

(C) 1 (D) -1

3. Force $\mathrm{F} = \mathrm{P}\cos(\mathrm{Ax}) + \mathrm{QSin(Bt)}$ where x and t are displacement and time respectively. Which one of the following physical quantity has the dimensions of $\left[\frac{\mathrm{B}}{\mathrm{A}}\right]$?

(A) velocity gradient (B) velocity

(C) angular velocity (D) angular momentum

4. A body of mass 5 kg is moving in a straight line. The relation between its displacement and time is $\mathrm{x} = \left(\mathrm{t}^3 - 2\mathrm{t} - 10\right)\mathrm{m}$. What is the force acting on it at the end of 5 second?

(A) 150 N (B) 120 N

(C) 80 N (D) 100 N

5. A train has to negotiate a curve of radius 'r' m, the distance between the rails is ″m and outer rail is raised above inner rail by distance of ' h′m. If the angle of banking is small, the safety speed limit on this banked road is

(A) $\sqrt{\mathrm{rg}\left(\frac{h}{\ell}\right)}$ (B) $\mathrm{rg}\frac{h}{\ell}$

(C) $\frac{\left(\frac{h}{\ell}\right)^2}{rg}$ (D) $\left(\mathrm{rg}\frac{h}{\ell}\right)^2$

6. Two masses of 1 gram and 4 gram are moving with equal kinetic energy. The ratio of the magnitudes of their momenta is

(A) 4 : 1 (B) $\sqrt{2} : 1$

(C) 1 : 12 (D) 1 : 16

7. A torque of 50Nm acts on a body for 8 second which is initially at rest. The change in its angular momentum is

(A) $400\mathrm{kgm}^2/\mathrm{s}$ (B) $600\mathrm{kgm}^2/\mathrm{s}$

(C) $1000\mathrm{kgm}^2/\mathrm{s}$ (D) $800\mathrm{kgm}^2/\mathrm{s}$

8. Two rings of same mass 'M' and radius 'R' are so placed that their centre is common and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to any one ring is

(A) $\frac{3\mathrm{MR}^2}{2}$ (B) $\frac{\mathrm{MR}^2}{2}$

(C) $\frac{2\mathrm{MR}^2}{3}$ (D) MR^2

9. The relative angular speed of hour hand and second hand of a clock is

(A) $\frac{359\pi}{21600}$ (B) $\frac{719\pi}{21600}$

(C) $\frac{11\pi}{21600}$ (D) $\frac{9\pi}{21600}$

10. A thin, uniform metal rod of mass 'M' and length 'L' is swinging about a horizontal axis passing through its end. Its maximum angular velocity is ' ω'. Its centre of mass rises to a maximum height of (g = acceleration due to gravity)

(A) $\frac{\mathrm{L}^2\omega^2}{6\,\mathrm{g}}$ (B) $\frac{\mathrm{L}^2\omega^2}{\mathrm{g}}$

(C) $\frac{\mathrm{L}^2\omega^2}{2\,\mathrm{g}}$ (D) $\frac{\mathrm{L}^2\omega^2}{3\,\mathrm{g}}$

11. The acceleration due to gravity on moon is $\left(\frac{1}{6}\right)^{\mathrm{th}}$ times the acceleration due to gravity on earth. If the ratio of the density of earth ' ϱ_e ' to the density of moon ϱ_m ' is $\frac{5}{3}$, then the radius of moon ' Rm ' in terms of the radius of earth 'Re' is

(A) $\left(\frac{7}{6}\right)\mathrm{Re}$ (B) $\left(\frac{3}{18}\right)\mathrm{Re}$

(C) $\left(\frac{5}{18}\right)\mathrm{Re}$ (D) $\left(\frac{1}{2\sqrt{3}}\right)\mathrm{Re}$

12. A rubber ball be taken in a deep sea so that its volume is decreased by $x\%$. The bulk modulus of rubber is 'K' and density of sea water is ' ϱ '. The depth to which a rubber ball is taken is proportional to (g = acceleration due to gravity)

(A) $\frac{\mathrm{ex}}{\mathrm{Kg}}$ (B) $\frac{\mathrm{Kx}}{\mathrm{eg}}$

(C) $\frac{\mathrm{eg}}{\mathrm{Kx}}$ (D) $\frac{\mathrm{Q}}{\mathrm{Kxg}}$

13. A transverse wave is travelling with velocity ' V′ through a metal wire of length ' L ' and density ' ρ '. The tensile stress in the wire is

(A) $V\rho^2$ (B) $\frac{v^2}{\rho}$

(C) $\frac{\rho}{V^2}$ (D) $V^2\rho$

14. In a sphere of influence, the liquid molecule at its centre is

(A) attracted by other molecules in the sphere of influence.

(B) repelled by other molecules lying outside the sphere of influence

(C) attracted by other molecules lying outside the sphere of influence.

(D) repelled by other molecules in the sphere of influence.

15. A metal sphere of mass 'm' and density ' σ_1 ' falls with terminal velocity through a container containing liquid. The density of liquid is ' σ_2 '. The viscous force acting on the sphere is

(A) $mg\left(1-\frac{\sigma_1}{\sigma_2}\right)$ (B) $mg\left(1-\frac{\sigma_2'}{\sigma_1}\right)$

(C) $mg\left(1+\frac{\sigma_1}{\sigma_2}\right)$ (D) $mg\left(1+\frac{\sigma_2}{\sigma_1}\right)$

16. Water rises to height $2\cdot2$ cm in glass capillary tube. The height to which same water rises in another capillary having $\frac{1}{4}$ area of cross-section is

(A) $16\cdot4$ cm (B) $4\cdot4$ cm

(C) $8\cdot4$ cm (D) $2\cdot2$ cm

17. A steel wire of length 'L' and area of cross-section 'A' is suspended from rigid support. If ' Y′ is the Young's modulus of material of the wire and ' α ' is the coefficient of linear expansion, then the increase in tension when temperature falls by t°C is

(A) $\frac{YA}{\alpha t}$ (B) $YA\alpha t$

(C) $Y\alpha t$ (D) $\frac{L\alpha t}{Y}$

18. If ' $\Delta Q'$ is the amount of heat supplied to 'n' moles of a diatonic gas at constant pressure, ' $\triangle U'$ is the change in internal energy and ' $\triangle W'$ is the work done, then $\Delta W : \Delta U : \Delta Q$ is

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

(C) 2 : 5 : 7 (D) 5 : 7 : 9

19. The quantity $\frac{PV}{KT}$ represents (K = Boltzmann constant)

(A) number of moles of gas.

(B) kinetic energy of gas

(C) mass of the gas

(D) number of molecules of gas in one mole

20. The length of seconds pendulum is 1 m on the earth. If the mass and diameter of the planet is double than that of the earth, then the length of the seconds pendulum on the planet will be

(A) 0.2 m (B) $0\cdot4$ m

(C) $0\cdot3$ m (D) 0.5 m

21. The linear displacement 'x' of the bob of simple pendulum from its mean position varies as $x = a\sin\left(\frac{\pi}{\sqrt{2}}t\right)$ where 'a' is its amplitude expressed in metre and 't' is in second. The length of simple pendulum is (Take ' $g' = \pi^2$ m/s^2)

(A) $1\cdot5$ m (B) $3\cdot0$ m

(C) $2\cdot0$ m (D) $2\cdot5$ m

22. A horizontal spring executes S.H.M. with amplitude 'A 1 ', when mass ' m_1'' is attached to it. When it passes through mean position another mass ' m_2 ' is placed on it. Both masses move together with amplitude ' A_2 '. Therefore $A_2 : A_1$ is

(A) $\left[\frac{m_2}{m_1+m_2}\right]^{1/2}$ (B) $\left[\frac{m_1+m_2}{m_1}\right]^{1/2}$

(C) $\left[\frac{m_1}{m_1+m_2}\right]^{1/2}$ (D) $\left[\frac{m_1+m_2}{m_2}\right]^{1/2}$

23. A particle performs S.H.M. Its potential energies are 'U $_1$ ' and ′U_2 ' at displacements ′x_1′ and ′x_2 ' respectively. At displacement $(x_1 + x_2)$, its potential energy ' U′ is

(A) $\sqrt{U} = \sqrt{U_1} + \sqrt{U_2}$

(B) $\sqrt{U} = \left(\sqrt{U_1} + \sqrt{U_2}\right)^2$

(C) $\sqrt{U} = \sqrt{U_1} - \sqrt{U_2}$

(D) $\sqrt{U} = \left(\sqrt{U_1} - \sqrt{U_2}\right)^2$

24. The speed of a wave in a certain medium is 960 m/s. If 900 waves pass over a certain point of the medium in half a minute, the wavelength of the wave is

(A) 16 m (B) 32 m

(C) 9 m (D) 18 m

25. The equation of vibration of a stretched string fixed at both ends and vibrating in 5^{th} harmonic is $Y = 3\sin(0 \cdot 4x)\cos(200\pi t)$ where 'x' and 'Y' are in cm and t in second. Length of the string is

(A) $(10 \cdot 5)\pi$cm (B) $(8 \cdot 5)\pi$cm

(C) $(12 \cdot 5)\pi$cm (D) $(4 \cdot 5)\pi$cm

26. A resonance tube completely filled with water has a small hole at the bottom. Length of the tube is 0.8 m. A vibrating tuning fork of frequency 500 Hz is held near the open end of tube. Water is slowly removed from the bottom. The maximum number of resonances heard will be (Neglect end correction. Speed of sound in air $= 340$ m/s)

(A) 5 (B) 4

(C) 2 (D) 3

27. A capacitor of unknown capacitance C is connected across a battery of V volt. The charge stored in it becomes Q coulomb. When potential across the capacitor is reduced by V′ volt, the charge stored in it becomes Q'coulomb. The capacitance C is

(A) $\frac{Q-Q'}{\sqrt{V'}}$ (B) $\frac{V'}{Q-Q'}$

(C) $\frac{Q+Q'}{V'}$ (D) $\frac{Q-Q'}{V'}$

28. A parallel plate capacitor has uniform electric field 'E' in the space between the plates. If the distance between plates is 'd' and area of each plate is 'A', the energy stored in the capacitor is ($\epsilon_0 =$ permittivity of free space)

(A) $\frac{1}{2}\frac{\epsilon_0 EA}{d}$ (B) $\frac{1}{2}\epsilon_0 E^2 Ad$

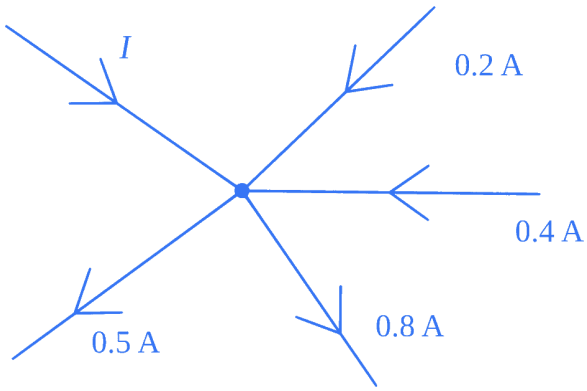
(C) $\frac{1}{2}\frac{\epsilon_0 Ad}{E^2}$ (D) $\frac{1}{2}\frac{\epsilon_0 E^2\ A}{d}$

29. The sensitivity of moving coil galvanometer is inversely proportional to

(A) current it measures. (B) number of turns in the coil.

(C) magnetic induction of horse shoe magnet (D) twist constant of phosphor

30. The value of current (I) in the given current distribution is



(A) $0 \cdot 7$ A (B) $0 \cdot 4$ A

(C) $0 \cdot 6$ A (D) 0.5 A

31. The length of potentiometer wire is 4 m and is connected in series with an accumulator. The e.m.f. (Unknown) of a cell balances against $1 \cdot 5$ m length of wire. If the length of potentiometer wire is doubled, then the new balancing length of wire will be

(A) 4.5 m (B) 1.5 m

(C) 0.75 m (D) 3 m

32. A toroid has a non-ferromagnetic wire of inner radius ' r_1' and outer radius ' r_2 ', around which 'N' turns of wire are wound. If the current in the wire is ' I', then the magnetic field inside the toroid is ($\mu_0 =$ permeability of free space)

(A) $\frac{\mu_0 NI}{\pi(r_1+r_2)}$ (B) $\frac{\mu_0 NI}{(r_2-r_1)}$

(C) $\frac{\mu_0 NI}{(r_1+r_2)}$ (D) $\frac{\mu_0 NI}{\pi(r_2-r_1)}$

33. A wire of magnetic material of length '2L' and magnetic moment 'M' is bent at the centre to form 'L' shaped wire. Its magnetic moment is

(A) $\frac{M}{\sqrt{2}}$ (B) M

(C) $\frac{M}{\sqrt{3}}$ (D) $\frac{M}{2}$

34. A circular arc of radius 'r' carrying current 'I' subtends on angle $\frac{\pi}{16}$ at its centre. The radius of a metal wire is uniform. The magnetic induction at the centre of çirçlar arç is

(A) $\frac{\mu_0 I}{16r}$ (B) $\frac{\mu_0 I}{32r}$

(C) $\frac{\mu_0 I}{64r}$ (D) $\frac{\mu_0 I}{8r}$

35. The materials having negative magnetic susceptibility are

(A) paramagnetic. (B) diamagnetic.

(C) ferromagnetic. (D) both paramagnetic and ferromagnetic.

36. In LCR circuit the inductance is changed from L to 9 L. For same resonant frequency the capacitance should be changed from C to

(A) 9C (B) 3C

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

37. A series LCR circuit has $R = 200\Omega$, $L = 663mH$ and $C = 26 \cdot 5\mu F$. The applied alternating voltage has an amplitude of 50 V and a frequency of 60 Hz so that $X_L = 250\Omega$ and $Xc = 100\Omega$. The peak current is

(A) 0.33 A (B) $0 \cdot 20$ A

(C) 0.50 A (D) $0 \cdot 25$ A

38. Let $'\mu_1'$ and $'\mu_2'$ be the refractive indices of two media. $' v_1'$ and $' v_2 '$ are the velocities of light in the media respectively. Which one of the following relations is TRUE?

(A) $\mu_1 v_1 = \mu_2 v_2$ (B) $\mu_2 v_1 = \mu_1 v_2$

(C) $\mu_1 v_1^2 = \mu_2 v_2^2$ (D) $\mu_2^2 v_1 = \mu_1^2 v_2$

39. According to Abbe, in the formula for resolving power of microscope, the numerical aperture is represented by

(A) $\frac{2\mu \sin\alpha}{\lambda}$ (B) $\frac{2 \sin\alpha}{\mu\lambda}$

(C) $\mu \sin\alpha$ (D) $\frac{\lambda}{2\mu \sin\alpha}$

40. An object is immersed in a fluid of refractive index $' \mu '$. In order that the object becomes invisible when observed from outside, it should

(A) have refractive index equal to one. (B) have refractive index same as surrounding fluid, that is $' \mu '$

(C) absorb all light falling on it. (D) behave as a perfect reflector.

41. A convex lens of focal length 'F' produces a real image 'n' times the size of the object. The image distance is

(A) $F(n+1)$ (B) $F(n-1)$

(C) $\frac{F}{(n+1)}$ (D) $\frac{F}{(n-1)}$

42. In a biprism experiment, the slit separation is 1 mm. Using monochromatic light of wavelength 5000Å, an interference pattern is obtained on the screen. Where should the screen be moved, so that the change in fringe width is $12 \cdot 5 \times 10^{-5}$ m ?

(A) Away or towards the slit by 25 am (B) Away or towards the slit by $12 \cdot 5$ cm

(C) Away from the slit by 5 cm (D) Towards the slit by 10 cm

43. How much energy is imparted to an electron so that its de-Broglie wavelength reduces from 10^{-10} m to $0 \cdot 5 \times 10^{-10}$ m?(E = energy of electron)

(A) 4E (B) 2E

(C) 3E (D) E

44. In experiment of photoelectric effect, the stopping potential for a given metal is $'V_0'$ volt, when radiation of wavelength $'\lambda_0'$ is used. If radiation of wavelength $'2\lambda_0'$ is used for the same metal, then the stopping potential (in volt) will be [e = charge on electron, c = speed of light, h = Planck's constant.]

(A) $V_0 + \frac{hc}{2e\lambda_0}$ (B) $V_0 - \frac{hc}{2e\lambda_0}$

(C) $\frac{V_0}{2}$ (D) $2\ V_0$

45. If the frequency of incident radiation is kept constant and the experiment is repeated by using incident light of different intensities, then stopping potential (V_s)

(A) increases with increase in intensity. (B) decreases with increase in intensity.

(C) depends upon current. (D) remains same.

46. In hydrogen spectrum, which of the following spectral series lies in ultraviolet region?

(A) Pfund (B) Lyman

(C) Paschen (D) Brackett

47. The electron in hydrogen atom is moving in an orbit of radius 0.53Å. It takes 1.571×10^{-16} s to complete one revolution. The velocity of electron will be $[\pi = 3 \cdot 142]$

(A) $5.3 \times 10^6 \frac{m}{s}$ (B) $4 \times 10^6 \frac{m}{s}$

(C) $3 \times 10^8 \frac{m}{s}$ (D) $2 \cdot 12 \times 10^6 \frac{m}{s}$

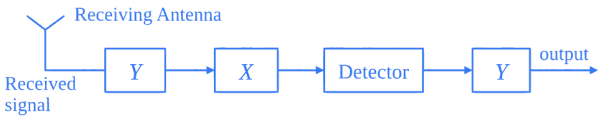
48. In common emitter mode of transistor, the d.c. current gain is 20 , the emitter current is 7 mA. The collector current is

(A) $16/3$ mA
(B) $13/3$ mA
(C) $8/3$ mA
(D) $20/3$ mA

49. The width of depletion layer of a p-n junction diode, when it is (i) forward biased and (ii) reverse biased respectively

(A) increases and increases.
(B) decreases and decreases.
(C) increases and decreases
(D) decreases and increases.

50. In communication system, for a given block diagram of receiver, the boxes ' X ' and "Y' respectively represent



(A) Detector and amplifier
(B) IF stage and amplifier
(C) IF stage and detector
(D) Amplifier and IF stage

51. The SI unit of pressure is

(A) $kgms^{-2}$ (B) $kg\ ms^2$

(C) $kg\ m^{-1}\ s^{-2}$ (D) $kg\ m^2\ s$

52. How many moles of ethene are required to prepare 6.0 g ethane by hydrogenation process?

(A) $0 \cdot 2$ mole (B) $0 \cdot 1$ mole

(C) $1 \cdot 0$ mole (D) $4 \cdot 0$ mole

53. According to molecular orbital theory, anti-bonding molecular orbitals of O_2 contain

(A) 4 electrons (B) 6 electrons

(C) 10 electrons (D) 8 electrons

54. What type of hybridization is present in PCl_5 molecule?

(A) sp^2 hybridization (B) sp^3 hybridization

(C) sp^3 d hybridization (D) $sp^3\ d^2$ hybridization

55. Which among the following gases liquefy easily?

(A) oxygen (B) helium

(C) chlorine (D) nitrogen

56. What is the value of ΔH° for the formation of ethanol from ethene gas and liquid water from following data? (i)

$C_2H_5OH_{(1)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)}\Delta$

$H^\circ = -1368$ kJ

(ii)

$C_2H_{4(g)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 2H_2O_{(l)}\Delta$

$H^\circ = 1410$ kJ

(A) $-1326 \cdot 0$ kJ (B) $-4188 \cdot 0$ kJ

(C) $-42 \cdot 0$ kJ (D) $-2778 \cdot 0$ kJ

57. Calculate the amount of work done during isothermal expansion of a gas from a volume of $4dm^3$ to $6dm^3$ against a constant external pressure of 3 atmosphere?

(A) $-30 \cdot 4$ J (B) $-60 \cdot 8$ J

(C) $-607 \cdot 8$ J (D) $-6 \cdot 0$ J

58. What is the value of $\Delta S_{(total)}$ for following reaction at 300 K

$Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow 2Fe_{(s)} + 3CO_{2(g)}\Delta$

$H^\circ = -25\ kJ, \Delta S^\circ = 15JK^{-1}$

(A) $68 \cdot 2JK^{-1}$ (B) $98 \cdot 3JK^{-1}$

(C) $8 \cdot 32JK^{-1}$ (D) $-10 \cdot 0JK^{-1}$

59. Which of the following hydride is deficient in hydrogen?

(A) LiH (B) KH

(C) NiH (D) NaH

60. Which among the following is used as a source of oxygen in submarine in emergency breathing apparatus?

(A) potassium superoxide (B) sodium peroxide

(C) rubidium superoxide (D) lithium monoxide

61. Which of the following groups does not show (+R) effect?

(A) - NH_2 (B) -NHCOR

(C) -CN (D) -NR

62. What is the volume of 1 mole of a crystalline solid having unit cell edge length 16×10^{-8} cm, if it's unit cell contains 24 molecules?

(A) $102 \cdot 7\ cm^3\ mol^{-1}$ (B) $404 \cdot 0\ cm^3\ mol^{-1}$

(C) $159 \cdot 3\ cm^3\ mol^{-1}$ (D) $142 \cdot 1\ cm^3\ mol^{-1}$

63. Sodium crystallises in bcc structure with radius $1 \cdot 86 \times 10^{-8}$ cm. Calculate the edge length of unit cell?

(A) 4.29×10^{-8} cm (B) $6 \cdot 20 \times 10^{-8}$ cm

(C) $8 \cdot 05 \times 10^{-8}$ cm (D) $3 \cdot 72 \times 10^{-8}$ cm

64. An element crystallises in bcc type crystal structure with edge length of unit cell 300pm. Calculate radius of element?

(A) $2 \cdot 299 \times 10^{-8}$ cm (B) $1 \cdot 299 \times 10^{-8}$ cm

(C) $6 \cdot 920 \times 10^{-8}$ cm (D) $1 \cdot 440 \times 10^{-8}$ cm

65. Which of following $0 \cdot 1$ m aqueous solution exhibits highest osmotic pressure at 25°C?

(A) urea (B) $CoCl_2$

(C) KCl (D) glucose

66. Which among the following is an example of Metal - metal ion electrode?

(A) Fe^{3+} (aq.), Fe^{2+} (aq.) |Pt

(B) $Cl^-{}_{(aq.)}|AgCl_{(s)}|Ag$

(C) Zn^{2+} (aq.) $|Zn_{(s)}$

(D) OH^- (aq.) $|O_{2(g),PO_2)}|Pt$

67. What is the relation between cell constant, conductivity and electrical resistance?

(A) $k = \frac{R}{b}$

(B) $k = \frac{b}{R}$

(C) $k = \frac{1}{R.b}$

(D) $k = R \cdot b$

68. Which among the following is an example of zero order reaction?

(A) Decomposition of N_2O in presence of catalyst

(B) Inversion of $C_{12}H_{22}O_{11}$

(C) Hydrolysis of CH_3COOCH_3

(D) Decomposition of N_2O_5

69. What is the unit of rate constant for the zero order reaction?

(A) mol $dm^{-3}t^{-1}$

(B) mol d m^3t^{-1}

(C) t^{-1}

(D) $moldm^{-3}t$

70. An amalgum of mercury with sodium is an example

(A) solid in liquid solution

(B) solid in solid solution

(C) liquid in liquid solution

(D) liquid in solid solution

71. Tyndall effect is observed due to

(A) neutralization of charge on colloidal particles

(B) Zig-zag motion of colloidal particles

(C) precipitation of colloidal particles

(D) Scattering of light by colloidal particles

72. Solution of chloroform in nitrogen is an example of

(A) liquid in gas

(B) liquid in solid

(C) liquid in liquid

(D) gas in liquid

73. Which among the following sources contains caryophyllene?

(A) Peppermint

(B) Oil of roses

(C) Oil of ginger

(D) Oil of cloves

74. Which reaction from following occurs at 2000 K in the blast furnace for extraction of iron?

(A) $CaO + SiO_2 \longrightarrow CaSiO_3$

(B) $CaCO_3 \longrightarrow CaO + CO_2$

(C) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

(D) $2C + O_2 \longrightarrow 2CO$

75. Which of the following is a product of first step and is used as reactant in next step for manufacture of $K_2Cr_2O_7$ from concentrated chromite ore ?

(A) Sodium dichromate

(B) Potassium chromate

(C) Sodium sulphate

(D) Sodium chromate

76. Which of the following oxyacids of chlorine does not contain lone pair of electron on chlorine atom?

(A) $HOClO_2$

(B) HOCl

(C) $HOClO_3$

(D) HOClO

77. How many lone pair of electrons are present on chlorine atom in hypochlorous acid?

(A) 1

(B) 3

(C) 2

(D) 4

78. Identify correct decreasing order of oxidizing power?

(A) $HClO > HClO_2 > HClO_3$

(B) $HClO > HClO_3 > HClO_2$

(C) $HClO_2 > HClO > HClO_3$

(D) $HClO_2 > HClO_3 > HClO$

79. Which from following elements has lowest tendency to form it's oxide?

(A) Al

(B) Fe

(C) Cr

(D) Hg

80. What is the oxidation number of Fe in $K_3[Fe(CN)_6]$?

(A) -6

(B) -3

(C) $+3$

(D) $+6$

81. Identify the ionic charge and magnetic nature respectively of manganate ion.

(A) -1, Diamagnetic

(B) -2, Diamagnetic

(C) -2, Paramagnetic

(D) -1, Paramagnetic

82. What is the type of magnetic behavior and geometry respectively in Cuproammonium sulphate (Atomic no. of Cu = 29)?

(A) Paramagnetic and tetrahedral
(B) Diamagnetic and pyramidal
(C) Diamagnetic and tetrahedral
(D) Paramagnetic and square planar

83. Which ligand among the following has highest splitting power of d-orbitals of central metal ion?

(A) S^{2-}
(B) OH^{-}
(C) NCS
(D) CO

84. When HCl is treated with propene in presence of sodium peroxide, the major product obtained is

(A) 1-Chloropropane
(B) 1, 2-dichloropropane
(C) 2-Chloropropane
(D) 2, 2-dichloropropane

85. Identify the name of reaction in which alkyl fluorides are prepared by heating alkyl bromide with metallic fluorides?

(A) Sandmeyer reaction
(B) Wurtz reaction
(C) Swarts reaction
(D) Finkelstein reaction

86. Identify Z in the following series of reactions:

$$CH_3-CH_2-CH_2-I \xrightarrow[\Delta]{KOH(alco.)} X \xrightarrow[peroxide]{HBr} Y \xrightarrow[alcohol]{KCN} Z$$

(A) $CH_3-CH_2-CH_2-CN$
(B) $CH_3-CH_2-CH_2-Br$



(C)
(D) $CH_3-CH=CH_2$

87. When methoxy benzene react with HI at room temperature the products formed are

(A) Iodomethane and Iodobenzene
(B) Iodomethane and Phenol
(C) Methanol and Iodobenzene
(D) Iodomethane and Benzene

88. Formation of p-hydroxyazobenzene from benzene diazonium chloride and phenol in mild alkaline medium is a

(A) nucleophilic substitution
(B) electrophilic addition
(C) nucleophilic addition
(D) electrophilic substitution

89. A reaction of phenol with chloroform in presence of sodium hydroxide to form salicylaldehyde is known as

(A) Reimer - Tiemann reaction
(B) Friedel craft's reaction
(C) Stephens reaction
(D) Kolbe's reaction

90. When phenol reacts with dilute nitric acid at room temperature, the major product obtained is

(A) p - nitrophenol
(B) m - nitrophenol
(C) 2, 4, 6 - trinitrophenol
(D) o- nitrophenol

91. Identify 'A' in the following reaction, $A \xrightarrow[Pd-BaSO_4]{H_2} C_6H_5CHO + HCl$

(A) Benzoic acid
(B) Benzyl chloride
(C) Benzoyl chloride
(D) Chlorobenzene

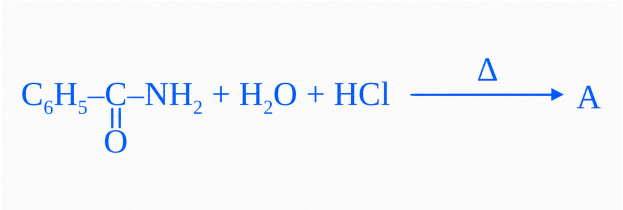
92. Which of the following is NOT dicarboxylic acid?

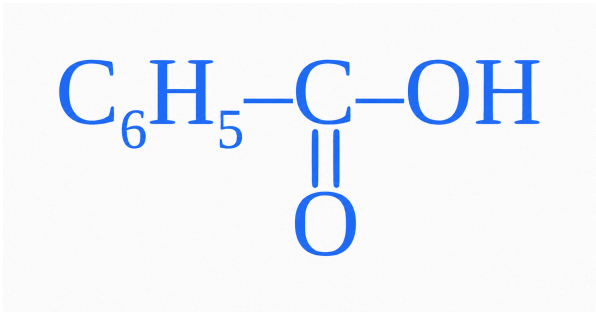
(A) Succinic acid
(B) Acrylic acid
(C) Malonic acid
(D) Phthalic acid

93. Benzene diazonium chloride on reaction with aniline in mild alkaline medium forms

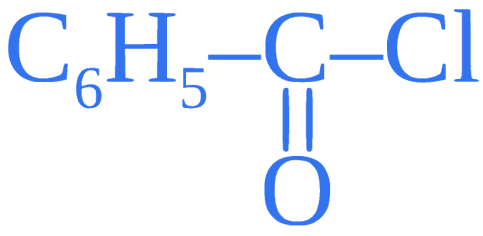
(A) yellow dye
(B) blue dye
(C) red dye
(D) orange dye

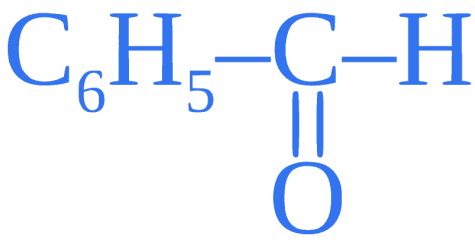
94. Identify product A in the following reaction.



(A) 

(B) $C_6H_5 - NH_2$

(C) 

(D) 

95. Which of the following amines can not be prepared by Gabriel phthalimide synthesis?

(A) Ethylamine (B) Sec-butylamine

(C) Aniline (D) Isopropylamine

96. What is the quantity of glucose obtained when 68.4 g of sucrose is hydrolyzed in laboratory under ideal condition ? (molar mass of sucrose $= 342\ g\ mol^{-1}$)

(A) $198 \cdot 0$ g (B) 180 g

(C) $68 \cdot 4$ g (D) $36 \cdot 0$ g

97. Identify the monomers used in preparation of PHBV polymer.

(A) Styrene and glycolic acid (B) Lactic acid and glycolic acid

(C) 3-Hydroxy butanoic acid and 3-hydroxy pentanoic acid (D) Glycine and ω amino caproic acid

98. Which among the following polymers belongs to the class elastomers?

(A) Polystyrene (B) Nylon

(C) Neoprene (D) Bakelite

99. Which of following is o-acetylsalicylic acid

(A) Aspirin (B) Equanil

(C) Veronal (D) Valium

100. Which of the following is NOT an antacid?

(A) $Al(OH)_3$ (B) $Mg(OH)_2$

(C) Na_2CO_3 (D) $NaHCO_3$

101. The domain of a function $f(y) = \frac{\cos^{-1}(y-5)}{\sqrt{25-y^2}}$ is

(A) $(4, 6]$ (B) $(-5, 5)$

(C) $[4, 5)$ (D) $(4, 5]$

102. If $f(x) = x^2 - 3x + 4$ and $f(x) = f(2x + 1)$, then $x =$

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

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

103. $\sin\left(\frac{\pi}{3} + x\right) - \cos\left(\frac{\pi}{6} + x\right) =$

(A) $-\cos x$ (B) $-\sin x$

(C) $\cos x$ (D) $\sin x$

104. If $x = 3\sin\theta, y = 3\cos\theta\cos\phi, z = 3\cos\theta\sin\emptyset$, then $x^2 + y^2 + z^2 =$

(A) 18 (B) 27

(C) 9 (D) 3

105. $\sin 690^\circ \times \sec 240^\circ =$

(A) 1 (B) -1

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

106. With usual notations, in triangle ABC, $a = \sqrt{3} + 1, b = \sqrt{3} - 1$ and $m\angle C = 60^\circ$, then $A - B =$

(A) 45° (B) 60°

(C) 30° (D) 90°

107. If $\frac{1}{4}$, a, b, $\frac{1}{19}$ form a H.P. then the values of a and b are respectively

(A) $\frac{1}{12}, \frac{1}{15}$ (B) $\frac{1}{5}, \frac{1}{7}$

(C) $\frac{1}{9}, \frac{1}{14}$ (D) $\frac{1}{11}, \frac{1}{17}$

108. If the origin is the centroid of the triangle whose vertices are A(2, p, -3), B(q, $-2, 5$) and C(-5, 1, r), then

(A) $p = -1, q = 3, r = -2$

(B) $p = 1, q = -3, r = -2$

(C) $p = 1, q = 3, r = 2$

(D) $p = 1, q = 3, r = -2$

109. If the points $A(5, k), B(-3, 1)$ and $C(-7, -2)$ are collinear, then k =

(A) 7 (B) $\frac{-1}{7}$

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

110. The separate equations of the lines represented by the equation $3x^2 - 2\sqrt{3}xy - 3y^2 = 0$ are

(A) $x - \sqrt{3}y = 0$ and $3x + \sqrt{3}y = 0$ (B) $x + \sqrt{3}y = 0$ and $3x + \sqrt{3}y = 0$

(C) $x - \sqrt{3}y = 0$ and $3x - \sqrt{3}y = 0$ (D) $x + \sqrt{3}y = 0$ and $3x - \sqrt{3}y = 0$

111. If the radius of a circle $x^2 + y^2 - 4x + 6y - k = 0$ is 5, then k =

(A) -12 (B) -25

(C) 25 (D) 12

112. If foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1\left(b^2 < 16\right)$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide, then the value of b^2 is

(A) 4 (B) 9

(C) 14 (D) 7

113. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a joint equation of directrices of the hyperbola $16x^2 - 9y^2 = 144$, then $g + f - c =$

(A) -81 (B) -25

(C) 81 (D) 25

114. Write the statement in symbolic form 'Sandeep neither likes tea nor coffee but enjoys a soft drink'. Where p : Sandeep likes tea q : Sandeep likes coffee r : Sandeep enjoys a soft drink

(A) $(\sim p \wedge q) \vee r$ (B) $(\sim p \wedge \sim q) \wedge r$

(C) $(\sim p \vee \sim q) \vee r$ (D) $(\sim p \vee \sim q) \wedge r$

115. The verbal statement of the same meaning, of the statement 'If the grass is green then it rains in July' is

(A) The grass is not green and it does not rains in July.

(B) The grass is not green or it rains in July.

(C) If the grass is not green, then it does not rain in July.

(D) The grass is not green if and only if it rains in July.

116. The principal value of $\sin^{-1}\left(-\frac{1}{2}\right)$ is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$

(C) $-\frac{\pi}{3}$ (D) $-\frac{\pi}{6}$

117. $2\tan^{-1}\left(\frac{1}{3}\right) - \tan^{-1}\left(\frac{3}{4}\right) =$

(A) 0 (B) 2

(C) 1 (D) 3

118. If $A = \begin{bmatrix}1 & 1\\ 1 & 2\end{bmatrix}, B = \begin{bmatrix}4 & 1\\ 3 & 1\end{bmatrix}$, then $(A+B)^{-1} =$

(A) $\frac{1}{7}\begin{bmatrix}3 & 2\\ 4 & 5\end{bmatrix}$ (B) $7\begin{bmatrix}3 & 2\\ 4 & 5\end{bmatrix}$

(C) $\frac{1}{7}\begin{bmatrix}3 & -2\\ -4 & 5\end{bmatrix}$ (D) $7\begin{bmatrix}3 & -2\\ -4 & 5\end{bmatrix}$

119. If $AX = B$, where $A = \begin{bmatrix}1 & -1 & 1\\ 2 & -1 & 0\\ 3 & 3 & -4\end{bmatrix}$, $B = \begin{bmatrix}1\\ 1\\ 2\end{bmatrix}$ and $X = \begin{bmatrix}x\\ y\\ z\end{bmatrix}$, then $x + y + z =$

(A) 2 (B) 3

(C) 6 (D) 1

120. If $f(x) = \frac{|x-2|}{x-2}$, for $x \neq 2$ $= 1$, for $x = 2$, then which of the following statements is true?

(A) $f(x)$ is continuous at $x = 2$

(B) $\lim_{x \to 2^-} f(x) = f(2)$

(C) $\lim_{x\to 2^+} f(x) = \lim_{x\to 2^-} f(x)$

(D) $f(x)$ is discontinuous at $x = 2$

121. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots\ldots$ then $\frac{dy}{dx} =$

(A) $y - 1$ (B) $y + 1$

(C) $y^2 - 1$ (D) y

122. If $\sqrt{x+y} + \sqrt{y-x} = 5$, then $\left(\frac{d^2y}{dx^2}\right) =$

(A) $\frac{2}{25}$ (B) $\frac{2}{5}$

(C) $\frac{-2}{5}$ (D) $\frac{-2}{25}$

123. If $x = a(1-\cos\theta), y = a(\theta - \sin\theta)$, then $\frac{d^2y}{dx^2} =$

(A) $\frac{\cos^2\left(\frac{\theta}{2}\right)}{2\,\text{acosec}\theta}$ (B) $\frac{\text{cosec}\,\theta}{2a\cos^2\left(\frac{\theta}{2}\right)}$

(C) $\frac{\cos\left(\frac{\theta}{2}\right)}{2\sin\theta}$ (D) $\frac{\sin\left(\frac{\theta}{2}\right)}{2a\cos\theta}$

124. The equation of normal to the curve $2x^2 + 3y^2 - 5 = 0$ at $P(1,1)$ is

(A) $3x + 2y + 1 = 0$ (B) $3x - 2y + 1 = 0$

(C) $3x + 2y - 5 = 0$ (D) $3x - 2y - 1 = 0$

125. 20 meters wire is available to fence a flower bed in the form of a circular sector. If the flower bed should have the greatest possible surface area, then the radius of the circle is

(A) 2 m (B) 4 m

(C) 5 m (D) 10 m

126. If line $x + y = 0$ touches the curve $ax^2 = 2y^2 - b$ at $(1,-1)$, then the values of a and b are respectively

(A) $0, 2$ (B) $-2, 0$

(C) $0, -2$ (D) $2, 0$

127. $\int \frac{4e^x + 6e^{-x}}{9e^x - 4e^{-x}}dx = Ax + B\log|9e^{2x} - 4| + c$, then (Where c is constant of integration)

(A) $A = \frac{3}{2}, B = \frac{35}{36}$ (B) $A = \frac{1}{2}, B = \frac{35}{36}$

(C) $A = \frac{-3}{2}, B = \frac{35}{36}$ (D) $A = \frac{-3}{2}, B = \frac{36}{35}$

128. $\int \frac{dx}{\cos 2x + \sin^2 x} =$

(A) $\sin x + c$ (B) $\tan x + c$

(C) $\sec^2 x + c$ (D) $\cos x + c$

129. $\int \frac{\cos\sqrt{x}}{\sqrt{x}}dx =$

(A) $\frac{1}{2}\cos\sqrt{x} + c$ (B) $2\sin\sqrt{x} + c$

(C) $\frac{1}{2}\sin\sqrt{x} + c$ (D) $2\cos\sqrt{x} + c$

130. $\int_0^1 \frac{x^2}{1+x^2}dx =$

(A) $1 + \frac{\pi}{4}$ (B) $1 - \frac{\pi}{4}$

(C) $1 - \frac{\pi}{2}$ (D) $1 + \frac{\pi}{2}$

131. $\int_0^{\frac{\pi}{2}} \left(e^{\sin x} - e^{\cos x}\right)dx =$

(A) $\frac{1}{2}$ (B) 0

(C) 1 (D) $\frac{\pi}{4}$

132. $\int_{-2}^{1}[x+1]dx =$ (Where $[x]$ is greatest integer function not greater than x)

(A) 1 (B) 0

(C) -1 (D) 2

133. The area bounded by the parabola $y^2 = 16x$ and its latus - rectum in the first quadrant is

(A) 128 sq. units (B) $\frac{64}{3}$ sq. units

(C) $\frac{128}{3}$ sq. units (D) 64 sq. units

134. The general solution of the differential equation $\left(1-x^2\right)\frac{dy}{dx}+2xy=x\left(1-x^2\right)^{\frac{1}{2}}$ is

(A) $y=\sqrt{1-x^2}+c\left(1-x^2\right)$

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

(C) $y=2\sqrt{1-x^2}+c\left(1+x^2\right)$

(D) $y\sqrt{1-x^2}=c\left(1-x^2\right)$

135. The particular solution of the differential equation $\cos\left(\frac{\mathrm{dy}}{\mathrm{dx}}\right)=a$, under the conditions $a\epsilon R$ and $y(0)=2$ is

(A) $\cos\left(\frac{x-2}{y-2}\right)=a$ (B) $\cos^{-1}\left(\frac{y-2}{x}\right)=a$

(C) $\cos\left(\frac{y-2}{x}\right)=a$ (D) $\cos\left(\frac{x-2}{y+2}\right)=a$

136. The rate of decay of mass of a certain substance at time 't' is proportional to the mass at that instant. The time during which the original mass of m_0 gm. will be left to $m_1$gm. is (K is constant of proportionality)

(A) $\mathrm{K}\log\left(\frac{m_1}{m_0}\right)$ (B) $\left(\frac{1}{\mathrm{K}}\right)\log\left(\frac{m_1}{m_0}\right)$

(C) $\left(\frac{1}{\mathrm{K}}\right)\log\left(\frac{m_0}{m_1}\right)$ (D) $\mathrm{K}\log\left(\frac{m_0}{m_1}\right)$

137. The differential equation whose solution is $y=c_1\mathrm{cosax}+c_2\mathrm{sinax}($ Where c_1 and c_2 are arbitrary constants) is

(A) $\frac{d^2y}{dx^2}-a^2y=0$ (B) $\frac{d^2y}{dx^2}+a^2y=0$

(C) $\frac{d^2y}{dx^2}+ay^2=0$ (D) $\frac{d^2y}{dx^2}+y^2=0$

138. The population P(t) of a certain mouse species at time t satisfies the differential equation $\frac{dP(t)}{dt}=0\cdot5P(t)-450\cdot$ If $\mathrm{P}(0)=850$, then the time at which the population becomes zero is

(A) $\left(\frac{1}{2}\right)\log 18$ (B) $\log 18$

(C) $2\log 18$ (D) $\log 9$

139. If $\bar{a}=\hat{\imath}+5\hat{k},\bar{b}=2\hat{\imath}+3\hat{k},\bar{c}=4\hat{\imath}-\hat{\jmath}+2\hat{k}$ and $\bar{d}=\hat{\imath}-\hat{\jmath}$, then $(\bar{c}-\bar{a})\cdot(\bar{b}\times\bar{d})=$

(A) 12 (B) 20

(C) 30 (D) 10

140. If a, b, c are non-negative distinct numbers and $a\hat{\imath}+a\hat{\jmath}+c\hat{k},\hat{\imath}+\hat{k}$ and $c\hat{\imath}+c\hat{\jmath}+b\hat{k}$ are coplanar vectors, then

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

(C) a, c, b are in G.P. (D) a, b, c are in A.P.

141. The shortest distance between the lines $1+x=2y=-12z$ and $x=y+2=6z-6$ is

(A) 1 unit (B) 4 units

(C) 2 units (D) 3 units

142. If the direction cosines of a line are $\frac{1}{c},\frac{1}{c},\frac{1}{c}$ then

(A) $2<\mathrm{c}<3$ (B) $\mathrm{c}=\pm3$

(C) $\mathrm{c}=\pm\sqrt{3}$ (D) $\mathrm{c}=\pm\frac{1}{\sqrt{3}}$

143. The angle between the lines $\frac{x-1}{4}=\frac{y-3}{1}=\frac{z}{8}$ and $\frac{x-2}{2}=\frac{y+1}{2}=\frac{z-4}{1}$ is

(A) $\sin^{-1}\left(\frac{2}{3}\right)$ (B) $\cos^{-1}\left(\frac{2}{3}\right)$

(C) $\cos^{-1}\left(\frac{1}{3}\right)$ (D) $\sin^{-1}\left(\frac{1}{3}\right)$

144. The equation of a plane containing the lines $\bar{\mathrm{r}}=(\hat{\imath}+2\hat{\jmath}-4\hat{\mathrm{k}})+\lambda(2\hat{\imath}+3\hat{\jmath}+6\hat{\mathrm{k}})$ and $\bar{\mathrm{r}}=(\hat{\imath}+3\hat{\jmath}+4\hat{\mathrm{k}})+\mu(\hat{\imath}+\hat{\jmath}-\hat{\mathrm{k}})$ is

(A) $9x+8y+z+11=0$

(B) $9x-8y-z-11=0$

(C) $9x-8y-z+11=0$

(D) $9x-8y+z+11=0$

145. If the points $(1,1,\lambda)$ and $(-3,0,1)$ are equidistant from the plane $3x+4y-12z+13=0$, then integer value of λ is

(A) 2 (B) 1

(C) 3 (D) 4

146. The minimum value for the LPP $\mathrm{Z}=6x+2y$, subject to $2x+y\geq16,x\geq6,y\geq1$ is

(A) 44 (B) 47

(C) 24 (D) 34

147. In a box containing 100 bulbs, 10 are defective. The probability that out of 20 bulbs selected at random, none is defective is

(A) $10\left(\frac{1}{10}\right)^{20}$ (B) $20\left(\frac{9}{10}\right)^{20}$

(C) $5\left(\frac{1}{10}\right)^{20}$ (D) $\left(\frac{9}{10}\right)^{20}$

148. A fair coin is tossed 2 times. A person receives $₹X^3$ if he gets X number of heads. His expected gain is =

(A) ₹2.00 (B) ₹1.00

(C) ₹2.50 (D) ₹5.20

149. If $f(x) = \frac{x+2}{18}, -2 < x < 4 = 0$, otherwise, is the p. d. f. of a r. v. X, then the value of P(|X| < 2) is

(A) $\frac{5}{9}$ (B) $\frac{4}{9}$

(C) $\frac{2}{9}$ (D) $\frac{1}{9}$

150. If A and B are independent events and $P(A) = \frac{2}{3}, P(B) = \frac{3}{5}$, then $P(A' \cap B) =$

(A) $\frac{4}{15}$ (B) $\frac{3}{5}$

(C) $\frac{2}{5}$ (D) $\frac{1}{5}$

- End of Question Paper -