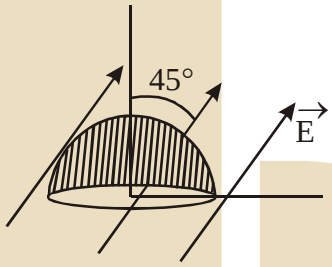
JEE-MAIN & AIEEE

PHYSICS

ONLINE EXAM TEST PAPERS OF 2012 (PAPER-3)

Q.1 The flat base of a hemisphere of radius a with no charge inside it lies in a horizontal plane. A uniform electric field $\vec{E}$ is applied at an angle $\frac{\pi}{4}$ with the vertical direction. The electric flux through the curved surface of the hemisphere is:-



(A) $\frac{\pi a^2 E}{\left(2\sqrt{2}\right)}$ (B) $\frac{\pi a^2 E}{\sqrt{2}}$ (C) $\frac{(\pi + a)\pi a^2 E}{\left(2\sqrt{2}\right)}$ (D) $\pi a^2 E$

Q.2 A charge of total amount Q is distributed over two concentric hollow spheres of radii r and R(R > r) such that the surface charge densities on the two spheres are equal. The electric potential at the common centre is:-

(A) $\frac{1}{4\pi \in_0}\frac{(R-r)Q}{2\left(R^2+r^2\right)}$ (B) $\frac{1}{4\pi \in_0}\frac{(R+r)Q}{\left(R^2+r^2\right)}$ (C) $\frac{1}{4\pi \in_0}\frac{(R+r)Q}{2\left(R^2+r^2\right)}$ (D) $\frac{1}{4\pi \in_0}\frac{(R-r)Q}{2\left(R^2+r^2\right)}$

Q.3 The amount of heat produced in an electric circuit depends upon the current (I), resistance (R) and time (t). If the error made in the measurements of the above quantities are 2% 1% and 1% respectively then the maximum possible error in the total heat produced will be

(A) 3% (B) 6% (C) 2% (D) 1%

Q.4 An electromagnetic wave with frequency to and wavelength λ travels in the +y direction. Its magnetic field is along- x axis. The vector equation for the associated electric field (of amplitude E_0) is:-

(A) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right)\hat{x}$ (B) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right)\hat{x}$

(C) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right)\hat{z}$ (D) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right)\hat{z}$

Q.5 A steel wire can sustain at the most 100 kg weight without breaking. If the wire is cut into equal parts, each part can sustain at the most a weight of:-

(A) 200 kg (B) 400 kg (C) 100 kg (D) 50 kg

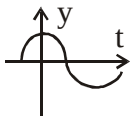
Q.6 Ionization energy of Li (Lithium) atom in ground stale is 5.4 eV. Binding energy of an electron in Li^+ ion in ground suit is 75.6 eV. Energy required to remote all three electrons of Lithium (Li) atom:

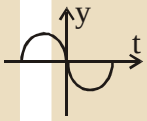
(A) 203 4eV (B) 135.4 eV (C) 81.0 eV (D) 156.6 eV

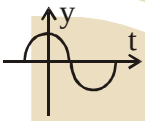
Q.7 A goods train acceleration uniformly on a straight railway track, approaches an electric pole standing on the side of track. Its engine passes the pole with velocity u and the guard's room passes with velocity v. The saddle wagon of the train passes the pole with a velocity:

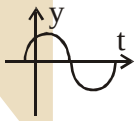
(A) $\sqrt{\left(\frac{u^2+v^2}{2}\right)}$ (B) $\frac{1}{2}\sqrt{u^2+v^2}$ (C) $\sqrt{uv}$ (D) $\frac{u+v}{2}$

Q.8 The displacement $y(t) = A\sin(\omega t + \phi)$ of a pendulum for $\phi = 2\pi/3$ is represented correctly by

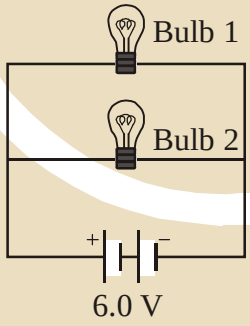
(A) 

(B) 

(C) 

(D) 

Q.9 A 6.0 volt battery is connected to two light bulbs as shown in figure. Light bulb 1 has resistance 3 Ohm while light bulb 2 has resistance 6 Ohm. Battery has negligible internal resistance. Which bulb will glow more?



(A) Bulb 1 will glow more first and then its brightness will become less than bulb 2

(B) Bulb 2

(C) Both glow equally

(D) Bulb 1

PHYSICS

Q.10 A block of weight W rests on a horizontal floor with coefficient of static friction μ. It is described to make the block move by applying minimum amount of force. The angle q from the horizontal at which the force should be applied and the magnitude F of the force is:

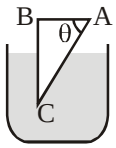
(A) $\theta = \tan^{-1}\left(\frac{\mu}{1+\mu}\right), F = \frac{\mu W}{1+\mu}$ (B) $\theta = 0, F = \mu W$

(C) $\theta = \tan^{-1}(\mu), F = \frac{\mu W}{\sqrt{1+\mu^2}}$ (D) $\theta = \tan^{-1}\left(\frac{1}{\mu}\right), F = \frac{\mu W}{\sqrt{1+\mu^2}}$

Q.11 The decay constants of a radioactive substance for α and β emission are λ_α and λ_β respectively. If the substance emits α and β simultaneously, then the average half life of the material will be:

(A) $\frac{1}{2}(T_\alpha + T_\beta)$ (B) $T_\alpha + T_\beta$ (C) $\frac{2T_\alpha T_\beta}{T_\alpha + T_\beta}$ (D) $\frac{T_\alpha T_\beta}{T_\alpha + T_\beta}$

Q.12 A glass prism of refractive index 1.5 is immersed in water (refractive index 4/3) as shown in the figure. A light beam incident normally on the face AB is totally reflected to reach the face BC, if:



(A) sin θ > 5/9 (B) sin θ > 1/3 (C) sin θ > 2/3 (D) sin θ > 8/9

Q.13 A generator has armature resistance of 0.1Ω and develops an induced emf of 120 V when driven at its rated speed. Its terminal voltage when a current of 50 A is being drawn is:

(A) 5 V (B) 115 V (C) 70 V (D) 120 V

Q.14 Two coherent plane light waves of equal amplitude make a small angle α (< < 1) with each other. They fall almost normally on a screen. If λ the wavelength of light waves the fringe width Δx of interference patterns of the two sets of waves on the screen is :-

(A) λ/ α (B) λ/(2α) (C) 2λ/α (D) $\frac{1}{\sqrt{\alpha}}$

Q.15 A large number of droplets, each of radius, r coalesce to form a bigger drop of radius R. An engineer designs a machine so that the energy released in this process is converted into the kinetic energy of the drop. Velocity of the drop is (T = surface Tension ; ρ = density):

(A) $\left[\frac{T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$ (B) $\left[\frac{2T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$ (C) $\left[\frac{3T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$ (D) $\left[\frac{6T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$

Q.16 Two point masses of mass $m_1 = fM$ and $m_2 = (1 - f) M$ ($f < 1$) are in outer space (far from gravitational influence of other objects) at a distance R from each other. They move in circular orbits about their centre of mass with angular velocities ω_1 for m_1 and ω_2 for m_2. In that case:

(A) $\omega_1 = \omega_2$ and independent of f (B) $f\omega_1 = (1 - f)\omega_2$

(C) $\omega_1 = \omega_2$ and depend of f (D) $(1 - f)\omega_1 = f\omega_2$

Q.17 A uniform tube of length 60.5 cm is held vertically with its lower end dipped in water. A sound source of frequency 500 Hz sends sound waves into the tube. When the length of tube above water is 16 cm and again when it is 50 cm, the tube resonates with the source of sound. Two lowest frequencies (in Hz), to which tube will resonate when it is taken out of water are (approximately):

(A) 281, 843 (B) 281. 562 (C) 272, 544 (D) 276. 552

Q.18 The pressure of an ideal gas varies with volume as P = **a**V, where a is a constant. One mole of the gas is allowed to undergo expansion such that its volume becomes 'm' times its initial volume. The work done by the gas in the process is:

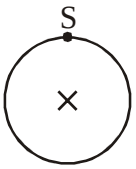
(A) $\frac{\alpha V}{2}\left(m^2-1\right)$ (B) $\frac{\alpha V^2}{2}\left(m^2-1\right)$ (C) $\frac{\alpha^2 V^2}{2}\left(m^2-1\right)$ (D) $\frac{\alpha}{2V}\left(m^2-1\right)$

(C)

Q.19 A proton and deuteron are both accelerated through the same potential difference and enter in a magnetic field perpendicular to the direction of the field. If the deuteron follows a path of radius R, assuming the neutron and proton masses are nearly equal, the radius of the proton's path will be:

(A) $\sqrt{2}R$ (B) $\frac{R}{\sqrt{2}}$ (C) $\frac{R}{2}$ (D) R

Q.20 A ring is suspended from a point S on its rim as shown in the figure. When displaced from equilibrium, it oscillates with time period of 1 second. The radius of the ring is (take $g = \pi^2$):-



(A) 0.15 m (B) 0.5 m (C) 1.0 m (D) 1.5 m

Q.21 A moving particle of mass m, makes a head on elastic collision with another particle of mass 2m, which is initially at rest. The percentage loss in energy of the colliding particle on collision is close to:-

(A) 10% (B) 90% (C) 33% (D) 67%

Q.22 This question has Statement –1. Statement –2. Of the four choices given after the statement, choose the one that best describes the two statements.

Statement–1 : An inventor claims to have constructed an engine that has an efficiency of 30% when operated between the boiling and freezing points of water. This is not possible.

Statement–2 : The efficiency of a real engine is always less than the efficiency of a Carnot engine operating between the same two temperatures.

(A) Statement–1 is true, Statement–2 is true and Statement–2 is the correct explanation of Statement–1.

(B) Statement–1 is true, Statement–2 is true and Statement–2 is not the correct explanation of statement–1.

(C) Statement–1 is true, Statement–2 is false (D) Statement–1 is false, Statement–2 is true

Q.23 Sand is being dropped on a conveyor belt at the rate of 2 kg per second. The force necessary to keep the belt moving with a constant speed of 3 ms^{-1} will be:

(A) 12 N (B) 6 N (C) 18 N (D) zero

Q.24 This question has Statement 1, Statement 2. Of the four choices given after the statement, choose the one that best describes the two statements.

Statement–1 : Self inductance of a long solenoid of length L, total number of turns N and radius r is less than $\frac{\pi\mu_0 N^2 r^2}{L}$.

Statement–2 : The magnetic induction in the solenoid in Statement 1 carrying current I is $\frac{\mu_0 NI}{L}$ in the middle of the solenoid but becomes less as we move towards its ends.

(A) Statement–1 is true, Statement–2 is true and Statement–2 is the correct explanation of Statement–1.

(B) Statement–1 is true, Statement–2 is true and Statement–2 is not the correct explanation of statement–1.

(C) Statement–1 is true, Statement–2 is false

(D) Statement–1 is false, Statement–2 is true

Q.25 Given the electric field of a complete amplitude modulated wave as

$$\vec{E} = \hat{i}E_C\left(1+\frac{E_m}{E_C}\cos\omega_m t\right)\cos\omega_C t$$

Where the subscript C stands for the carrier wave and m for the modulating signal. The frequencies present in the modulated wave are:

(A) ω_C and $\sqrt{\omega_C^2+\omega_m^2}$ (B) ω_C , $\omega_C + \omega_m$, $\omega_C - \omega_m$

(C) ω_C and ω_m (D) ω_C and $\sqrt{\omega_C\omega_m}$

Q.26 This question has Statement 1. Statement 2. Of the four choices given after the statement. choose the one that best describes the two statements.

Statement–1 : A metallic surface is irradiated by a monochromatic light of frequency $v > v_0$ (the threshold frequency). If the incident frequency is now doubled, the photocurrent and the maximum kinetic energy are also doubled.

Statement–2 : The maximum kinetic energy of photoelectrons emitted from a surface is linearly dependent on the frequency of the incident light The photocurrent depends only on the intensity of the incident light.

(A) Statement–1 is true, Statement–2 is true and Statement–2 is the correct explanation of Statement–1.

(B) Statement–1 is true, Statement–2 is true and Statement–2 is not the correct explanation of statement–1.

(C) Statement–1 is true, Statement–2 is false. (D) Statement–l is false, Statement–2 is true.

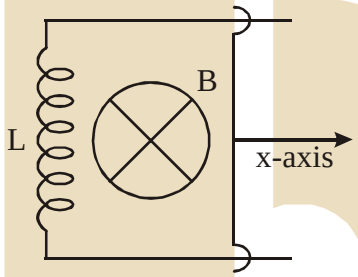
Q.27 N divisions on the main scale of a vernier calipers coincide with (N + 1) divisions of the vernier, scale. If each division of main scale is 'a' units, then the least count of the instrument is:

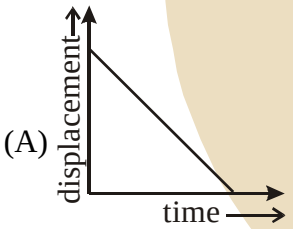
(A) a/N (B) $\frac{N}{N+1}\times a$ (C) a (D) a/N+1

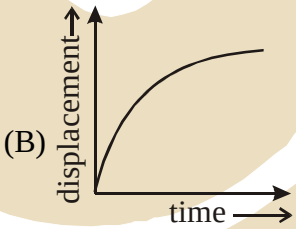
Q.28 A large cylindrical rod of length L is made by joining two identical rods of copper and steel of length (L/2) each. The rods are completely insulated from the surroundings. If the free end of the copper rod is maintained at 100°C and that of steel at 0°C then the temperature of junction is (thermal conductivity of copper is 9 times that of steel):-

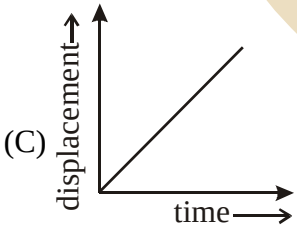
(A) 90°C (B) 10°C (C) 67°C (D) 50°C

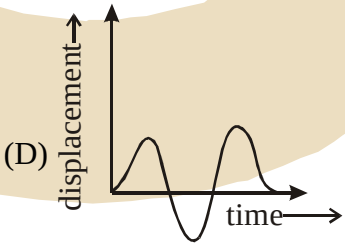
Q.29 A coil of self inductance L. is connected at one end of two rails as shown in figure. A connector of length *l*, mass m can slide freely over the two parallel rails. The entire set up is placed in a magnetic field of induction B going into the page. At an instant t = 0 an initial velocity v_0 is imparted to it and as a result of that it starts moving along x-axis. The displacement of the connector is represented by the figure:











Q.30 Which one of the following is the Boolean expression for NOR Gate?

(A) $Y = \overline{A}$ (B) $Y = \overline{A \cdot B}$ (C) Y = A.B (D $Y = \overline{A + B}$

Q.31 If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become:
(A) Two times (B) Half (C) One fourth (D) Four times

Q.32 Liquids A and B form an ideal solution. At 30°C, the total vapour pressure of a solution containing 1 mot of A and 2 moles of B is 250 mm Hg. The total vapour pressure becomes 300 mm Hg when 1 more mol of A is added to the first solution. The vapour pressures of pure A and B at the same temperature are
(A) 450, 150 mm Hg (B) 250, 300 mm Hg
(C) 125, 150 mm Hg (D) 150, 450 mm Hg

Q.33 The correct order of ligands in the spectrochemical series is :-
(A) $NCS^- > CN^- > CF > en$ (B) $CN^- > en > NCS^- > Cf$
(C) $Cl^- > en > CN^- > NCS^-$ (D) $en > CN^- > Cl^- > NCS^-$

Q.34 For a reaction $A \rightarrow$ Products, a plot of $\log t_{1/2}$ versus $\log a_0$ is shown in figure. If the initial concentration of A is represented by a_0, the order of the reaction is :-
(A) Two (B) Zero (C) One (D) Three

Q.35 Ammonium chloride crystallizes in a body centred cubic lattice with edge length, of unit cell of 390 pm. If the size of chloride ion is 180 pen, the size of ammonium ion would be:
(A) 158 pm (B) 174 pm (C) 142 pm (D) 126 pm

Q.36 When $CO_2(g)$ is passed over red hot coke it partially gets reduced to CO(g). Upon passing 0.5 litre of $CO_2(g)$ over red hot coke, the total volume of the gases increased to 700 mL. The composition of the gaseous mixture at STP is:-
(A) CO_2 = 200 mL ; CO = 500 mL (B) CO_2 = 350 mL ; CO = 350 mL
(C) CO_2 = 0.0 mL ; CO = 700 mL (D) CO_2 = 300 mL ; CO = 400 mL

Q.37 The value of K_P for the equilibrium reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ is 2. The percentage dissociation of $N_2O_4(g)$ at a pressure of 0.5 atm is
(A) 71 (B) 50 (C) 88 (D) 25

Q.38 Which of the following has the square planar structure :-
(A) NH_4^+ (B) CCl^4 (C) XeF^4 (D) BF_4^-

Q.39 Extraction of zinc from zinc blende is achieved by
(A) Electrolytic reduction
(B) Roasting followed by reduction with carbon
(C) Roasting followed by reduction with another metal
(D) Roasting followed by self - reduction

Q.40 If K_{SP} of CaF_2 at 25°C is 1.7 × 10-10, the combination amongst the following which gives a precipitate of CaF_2 is:-

(A) 1×10^2 M Ca^{2+} and 1×10^{-5} M F^- (B) 1×10^{-4} M Ca^{2+} and 1×10^{-4} M F^-

(C) 1×10^{-3} M $Ca^{2+}$and 1×10^{-5} M F^- (D) 1×10^{-2} M Ca^{2+} and 1×10^{-3} M F^-

Q.41 The compound of Xenon with zero dipole moment is:-

(A)XeO_3 (B) XeO_2 (C) XeF_4 (D)$XeOF_4$

Q.42 Reagent used to convert allyl alcohol to acroletin is:-

(A) MnO_2 (B) $KMnO_4$ (C) OsO_4 (D) H_2O_2

Q.43 The major product obtained in the photobromination of 2-methyl butane is:

(A) 2-bromo-3-methyl butane (B) l-bromo-2-methyl butane

(C) l-bromo-3-methyl butane (D) 2-bromo-2-methyl butane

Q.44 An open vessel at 300 K is heated till 2/5 th of the air in it is expelled. Assuring that the volume of the vend raniis constant, the temperature to which the vessel is heated is :-

(A) 750 K (B) 400K (C) 500K (D) 1500K

Q.45 Which of the fallowing is a poly amide :-

(A) Orloa (B) Terylene (C) Teflon (D) Nylon

Q.46 Square-planar geometry is shown by :-

(A) $[NiCl_4]^{2-}$ (B) CrO_4^{2-} (C) MnO_4^- (D) $[PtCl_2(NH_3)_2]$

Q.47 Which pair of elements with the given atomic numbers is expected to have similar properties?

(A) 11, 12 (B) 40, 72 (C) 20, 36 (D) 10, 28,

Q.48 Which of the following is a non-reducing sugar?

(A) Sucrose (B) Fructose (C) Maltose (D) Lactose

Q.49 The standard potentials of Ag^+ / Ag, Hg_2^{2+} / 2Hg, Cu^{2+} / Cu and Mg^{2+} / Mg electrodes are 0.80, 0.79, 0.34 and – 2.37 V, respectively. An aqueous solution which contains one mole per litre of the salts of each of the four metals is electrolyzed. With increasing voltage, the correct sequence of deposition of the metals at the cathode is:-

(A) Cu, Hg, Ag only (B) Mg, Cu, Hg, Ag (C) As, Hg, Cu only (D) Ag. Hg, Cu, Mg

Q.50 Aspirin can be prepared by the reaction of :-

(A) Salicylic acid with methanol in presence of

(B) Salicyldehyde with acetic anhydride in presence of H_2SO_4

(C) Salicylic acid with acetic anhydride in presence of H_2SO_4

(D) Cinnamic acid with acetic anhydride in presence of H_2SO_4

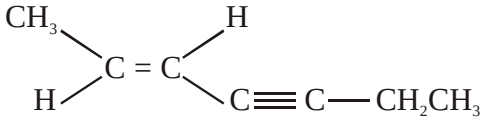
Q.51 Which one of the following will react most vigorously with water?

(A) Li (B) K (C) Rb (D) Na

Q.52 Which of the following paramagnetic ions would exhibit a magnetic moment (spin only) of the order of 5 BM? (At. Nos : Mn = 25, Cr = 24. V = 23. Ti = 22)

(A) V^{2+} (B) Ti^{2+} (C) M_n^{2+} (D) Cr^{2+}

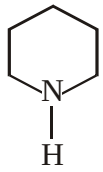
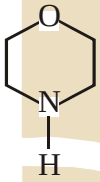
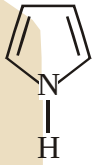
Q.53 The IUPAC name of the following compounds is :



(A) (Z)–5 – hepten–3–yne (B) (Z) –2 –hepten – 4 – yne
(C) (E) –5 –hepten – 3– yne (D) (E)–2 –hepten –4–yne

Q.54 The enthalpy of neutralization of NH_4OH with HCl is –51.46 kJ mol^{-1} and the enthalpy of neutralization of NaOH with HCl is –55.90 kJ mol^{-1}. The enthalpy of ionization of NH_4OH is:
(A) +107.36 kJ mol^{-1} (B) –4.44 kJ mol^{-1}
(C) –107.36 kJ mol^{-1} (D) +4.44 kJ mol^{-1}

Q.55 The order of basicity of the compounds:

(I)  (II)  (III)  (IV) 

(A) II > I >III > IV (B) III > I > IV > II (C) IV > I > III > II (D) I > III > II > IV

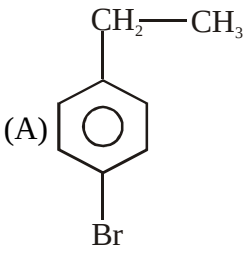
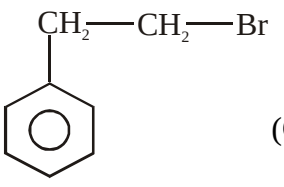
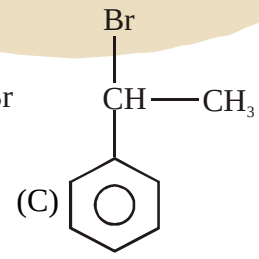
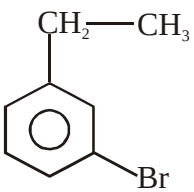
Q.56 On addition of 1 mL of 10% NaCI solution to 10 mL gold sol in the presence of 0.025 g of starch, the coagulation is just prevented. Starch has gold number:
(A) 25 (B) 2.5 (C) 0.025 (D) 0.25

Q.57 Among the following the molecule with the lowest dipole moment is:
(A) $CHCl_3$ (B) $CHCl_2$ (C) CCl_4 (D) CH_3CI

Q.58. Beilstein test is used for estimation of which one of following elements?
(A) S (B) Cl (C) C and H (D) N

Q.59 Fog is a colloidal solution of :-
(A) Gaseous particles dispersed in a liquid (B) Solid particles dispersed in a liquid
(C) Liquid particles dispersed in gas (D) Solid particle dispersed in gas

Q.60. The product of the reaction between ethyl benzene and N-bromo succinamide is:

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

Q.61 Let L be the line y = 2x, in the two dimensional plane.

Statement-1 : The image of the point (0, 1) in is the point $\left(\frac{4}{5},\frac{3}{5}\right)$.

Statement-2 : The points (0, 1) and $\left(\frac{4}{5},\frac{3}{5}\right)$ lie on opposite sides of the line L and are at equal distance from it.

(A) Statement –1 is true, Statement –2, is true and Statement –2 is the correct explanation of Statement–1.

(B) Statement –1 is true, Statement –2, is true and Statement –2 is not the correct explanation of Statement –1.

(C) Statement –1 is true, Statement–2 is false.

(D) Statement –1 is false, Statement–2 is true.

Q.62 If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, $|\vec{a}|=3$, $|\vec{b}|=5$ and $|\vec{c}|=7$, then the angle between $\vec{a}$ and $\vec{b}$ is :

(A) $\pi/3$ (B) $\pi/2$ (C) $\pi/6$ (D) $\pi/4$

Q.63 If A^T denotes the transpose of the matrix $A=\begin{bmatrix}0 & 0 & a\\ 0 & b & c\\ d & e & f\end{bmatrix}$, where a, b, c, d, e and f are integers such that $abd \neq 0$ then the number of such matrices for which $A^{-1}=A^T$ is:-

(A) 32 (B) 23 (C) 2(3!) (D) 3(2!)

Q.64 If $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$, $\vec{b}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{c}=r\hat{i}+\hat{j}-(2r-1)\hat{k}$ are three vectors such that $\vec{c}$ is parallel to the plane of $\vec{a}$ and $\vec{b}$ then r is equal to :-

(A) 0 (B) 2 (C) –1 (D) 1

Q.65 If three distinct points A, B, C are given in the 2–dimensional coordinate plane such that the ratio of the distance of each one of them from the point (1, 0) to the distance from (–1, 0) is equal to 1/2, then the circumcentre of the triangle ABC is at the point:

(A) $\left(\frac{1}{3},0\right)$ (B) (3, 0) (C) (0, 0) (D) $\left(\frac{5}{3},0\right)$

Q.66 **Statement–1:** The shortest distance between the lines $\frac{x}{2}=\frac{y}{-1}=\frac{z}{2}$ and $\frac{x-1}{4}=\frac{y-1}{-2}=\frac{z-1}{4}$ is $\sqrt{2}$.

Statement–2 : The shortest distance between two parallel lines is the perpendicular distance from any point on one of the lines to the other line.

(A) Statement –1 is true, Statement –2 is true and Statement –2 is the correct explanation of Statement–1.

(B) Statement –1 is true, Statement –2 is true and Statement –2 is not the correct explanation of Statement –1.

(C) Statement –1 is true, Statement–2 is false.

(D) Statement –1 is false, Statement–2 is true.

Q.67 If $f(x)=\int\left(\frac{x^2+\sin^2 x}{1+x^2}\right)\sec^2 x\,dx$ and f(0) = 0, then f(l) equals :-

(A) tan 1 + 1 (B) $1-\pi/4$ (C) $\tan 1-\pi/4$ (D) $\pi/4$

Q.68 If $n = {}^mC_2$, then the value of ${}^nC_2$ is given by:-

(A) $2({}^{m+2}C_4)$ (B) ${}^{m-1}C_4$ (C) ${}^{m+1}C_4$ (D) $3({}^{m+1}C_4)$

Q.69 The median of 100 observations grouped in classes of equal width is 25. If the median class interval is 20 - 30 and the number of observation less than 20 is 45, then the frequency of median class is :-

(A) 12 (B) 20 (C) 10 (D) 15

Q.70 If the three planes x = 5, 2x – 5ay + 3z – 2 = 0 and 3bx + y – 3z = 0 contain a common line, then (a, b) is equal to:

(A) $\left(-\frac{1}{5},\frac{8}{15}\right)$ (B) $\left(-\frac{8}{15},\frac{1}{5}\right)$ (C) $\left(\frac{1}{5},-\frac{8}{15}\right)$ (D) $\left(\frac{8}{15},-\frac{1}{5}\right)$

Q.71 If the line y = mx + 1 meets the circle $x^2 + y^2 + 3x = 0$ in two points equidistant from and on opposite sides of x-axis, then :-

(A) 2m – 3 = 0 (B) 2m + 3 = 0 (C) 3m + 2 = 0 (D) 3m – 2 = 0

Q.72 The general solution of the different equation $\frac{dy}{dx}+\frac{2}{x}y=x^2$, is:

(A) $y=cx^{-3}-\frac{x^2}{4}$ (B) $y=cx^{-2}-\frac{x^3}{5}$ (C) $y=cx^3-\frac{x^2}{4}$ (D) $y=cx^2-\frac{x^3}{5}$

Q.73 The equation of the normal to the parabola, $x^2 = 8y$ at $x = 4$ is :-

(A) $x + 2y = 0$ (B) $x + y = 2$ (C) $x - 2y = 0$ (D) $x + y = 6$

Q.74 A value of $\tan^{-1}\left(\sin\left(\cos^{-1}\sqrt{\frac{2}{3}}\right)\right)$ is :-

(A) $\pi/6$ (B) $\pi/2$ (C) $\pi/4$ (D) $\pi/3$

Q.75 Let $f : [1, 3] \to$ be a function satisfying $\frac{x}{[x]} < f(x) < \sqrt{6-x}$, for all $x \neq 2$ and $f(2) = 1$, where R is the set of all real numbers and [x] denotes the largest integer less than or equal to x.

Statement-1 : $\lim\limits_{x\to 2^-} f(x)$ exists.

Statement-2 : f is continuous at x = 2.

(A) Statement –1 is true, Statement –2 is true and Statement –2 is the correct explanation of Statement–1.

(B) Statement –1 is true, Statement –2 is true and Statement –2 is not the correct explanation of Statement –1.

(C) Statement –1 is true, Statement–2 is false. (D) Statement –1 is false, Statement–2 is true.

Q.76 If $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$, then $\lim\limits_{a\to 0}\frac{f(1-\alpha)-f(1)}{\alpha^3+3\alpha}$ is :

(A) $\frac{-53}{3}$ (B) $\frac{55}{3}$ (C) $\frac{53}{3}$ (D) $\frac{-55}{3}$

Q.77 The value of the integral $\int_0^{0.9}\left[x-2[x]\right]dx$, where $[\cdot]$ denotes the greatest integer function, is :

(A) – 0.9 (B) 0.9 (C) 0 (D) 1.8

Q.78 Consider a quadratic equation $ax^2 + bx + c = 0$, where $2a + 3b + 6c = 0$ and let $g(x) = a\frac{x^3}{3} + b\frac{x^2}{2} + cx$.

Statement-1 : The quadratic equation has at least one root in the interval (0. 1).

Statement-2: The Rolle's Theorem is applicable to function g(x) on the interval [0, 1].

(A) Statement –1 is true, Statement –2 is true and Statement –2 is the correct explanation of Statement–1.

(B) Statement –1 is true, Statement –2 is true and Statement –2 is not the correct explanation of Statement –1.

(C) Statement –1 is true, Statement–2 is false. (D) Statement –1 is false, Statement–2 is true.

Q.79 Suppose θ and ϕ ($\neq 0$) are such that $\sec(\theta + \phi)$, $\sec\theta$ and $\sec(\theta - \phi)$ are in A.P. If $\cos\theta = k\cos(\phi/2)$ for some k, then k is equal to :-

(A) $\pm\frac{1}{\sqrt{2}}$ (B) $\pm\sqrt{2}$ (C) ± 2 (D) ± 1

Q.80 Let Z and W be complex numbers such that $|Z| = |W|$ and arg Z denote the principal argument of Z.

Statement-1 : If $\arg Z + \arg W = \pi$, then $Z = -\overline{W}$.

Statemenl-2 : $|Z| = |W|$ implies $\arg Z - \arg \overline{W} = \pi$.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is the correct explanation of Statement-1.

(B) Statement-1 is true, Statement-2 is true and Statement-2 is not the correct explanation of statement-1.

(C) Statement-l is true, Statement-2 is false (D) Statement-1 is false, Statement-2 is true

Q.81 Let p, q, r $\in$ R and $r > p > 0$. If the quadratic equation $px^2 + qx + r = 0$ has two complex roots α and β then $|\alpha| + |\beta|$ is :-

(A) Less than 2 but not equal to 1

(B) Greater than 2

(C) Equal to 2

(D) Equal to 1

Q.82 If six students, including two particular students A and B, stand in a row, then the probability that A and B are separated with one student in between them is :-

(A) 2/15 (B) 1/5 (C) 4/15 (D) 8/15

Q.83 The area of the region bounded by the curve $y = x^3$, and the lines, $y = 8$ and $x = 0$, is:

(A) 12 (B) 10 (C) 8 (D) 16

Q.84 The weight W of a certain stock of fish is given by $W = nw$, where n is the size of stock and w is the average weight of a fish. If n and w change with lime us $n = 2t^2 + 3$ and $w = t^2 - t + 2$, then the rate of change of W with respect to t at $t = 1$ is :-

(A) 1 (B) 5 (C) 8 (D) 13

Q.85 If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ coin side with the foci of the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$, then b^2 is equal to :-

(A) 9 (B) 8 (C) 10 (D) 7

Q.86 The sum of the series $1+\frac{4}{3}+\frac{10}{9}+\frac{28}{27}+$_____ upto n terms is:-

(A) $n+\frac{1}{2}-\frac{1}{2.3^{n-1}}$ (B) $n-\frac{1}{3}-\frac{1}{3.2^{n-1}}$ (C) $\frac{5}{3}n-\frac{7}{6}+\frac{1}{2.3^{n-1}}$ (D) $\frac{7}{6}n+\frac{1}{6}-\frac{1}{3.2^{n-1}}$

Q.87 Let p and q be two statements. Amongst the following, the statement that is equivalent to $p \rightarrow q$ is:-

(A) $p \wedge \sim q$ (B) $\sim p \vee q$ (C) $\sim p \wedge q$ (D) $p \vee \sim q$

Q.88. If a, b, c are non zero complex numbers satisfying $a^2 + b^2 + c^2 = 0$ and

$$\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix} = k\, a^2 b^2 c^2$$, then k is equal to :-

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

Q.89 If P(S) denotes the set of all subsets of a given set S, then the number of one – to – one functions from the set S = {1, 2, 3} to the set P(S) is:-

(A) 24 (B) 8 (C) 336 (D) 320

Q.90 The number of arrangements that can be formed from the letters a, b, c, d, e, f, taken 3 at a time without repetition and each arrangement containing at least one vowel, is :-

(A) 72 (B) 96 (C) 24 (D) 128

ANSWER KEY										PAPER-3
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	B	B	D	A	A	A	A	D	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	D	D	B	Bonus	D	A	B	B	B	A
Q.	21	22	23	24	25	26	27	28	29	30
A.	B	B	B	A	B	D	D	A	D	D
Q.	31	32	33	34	35	36	37	38	39	40
A.	B	A	B	B	A	D	A	C	B	D
Q.	41	42	43	44	45	46	47	48	49	50
A.	C	A	D	C	D	D	B	A	C	C
Q.	51	52	53	54	55	56	57	58	59	60
A.	C	C	D	D	D	A	C	B	C	C
Q.	61	62	63	64	65	66	67	68	69	70
A.	B	A	B	A	D	A	C	D	C	C
Q.	71	72	73	74	75	76	77	78	79	80
A.	D	B	D	A	C	C	C	A	B	C
Q.	81	82	83	84	85	86	87	88	89	90
A.	B	C	A	D	D	A	B	B	C	B