TD : 02/11/2016

Aakash
Medical | IIT-JEE | Foundations
(Divisions of Aakash Educational Services Pvt. Ltd.)
Regd. Office : Aakash Tower, 8, Pusa Road, New Delhi-110005. Ph.: 011-47623456

Success Achiever for JEE (Main)-2018

(Test-1)

(Online)

Topics

Physics	:	Physical World, Units & Measurements, Motion in a Straight Line, Motion in a Plane, Laws of Motion, Work, Energy and Power, System of Particles and Rotational Motion
Chemistry	:	Some Basic Concept of Chemistry, Structure of Atom, Classification of Elements and Periodicity in Properties, Chemical Bonding and Molecular Structure, States of Matter, Thermodynamics, Equilibrium, Redox Reactions
Mathematics	:	Sets, Relations and Functions, Trigonometric Functions, Principle of Mathematical Induction, Complex Numbers and Quadratic Equations, Permutations and Combinations, Binomial Theorem

Instructions :

(i) Duration of Test is 3 hrs.

(ii) The Test booklet consists of 90 questions. The maximum marks are 360.

(iii) There are **three** parts in the question paper consisting of **Physics**, **Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted 4 **(four)** marks for each correct response.

(iv) One fourth (¼) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

PHYSICS

Choose the correct answer :

1. The length and breadth of a rectangular field are 12.5 m and 7.5 m respectively. The area of the field in appropriate significant figures and error limits is

   (1) $(93.8 \pm 2.0)m^2$

   (2) $(93.7 \pm 2.0)m^2$

   (3) $(93.75 \pm 2.00)m^2$

   (4) $(94 \pm 2)m^2$

2. If force F, velocity v and frequency f are considered to be fundamental quantities in a system of units then the dimensional formula for work in new system of units is

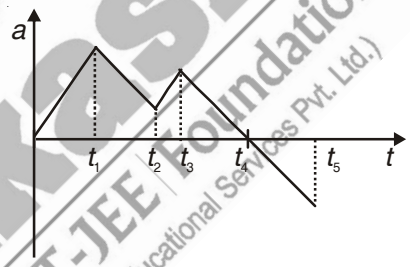
   (1) $[Fvf]$

   (2) $[Fvf^{-1}]$

   (3) $[Fv^{-1}f]$

   (4) $[F^2v^3f^{-2}]$

3. The acceleration-time graph of a particle starting from rest and moving on a straight line is shown in the figure. Time, at which speed of particle is maximum is



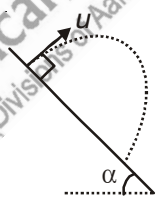
   (1) t_1 and t_3 both

   (2) t_2

   (3) t_4

   (4) t_5

4. A particle is projected perpendicularly upwards from an inclined surface of inclination α with the horizontal. Time when it again strikes the inclined plane is



   (1) $\frac{u}{g\sin\alpha}$

   (2) $\frac{2u\tan\alpha}{g}$

   (3) $\frac{2u\sec\alpha}{g}$

   (4) $\frac{2u\cot\alpha}{g}$

5. A vernier callipers has 1 mm marks on the main scale. It has 20 equal divisions on the vernier scale which match with 14 main scale divisions. For this vernier callipers, the least count is

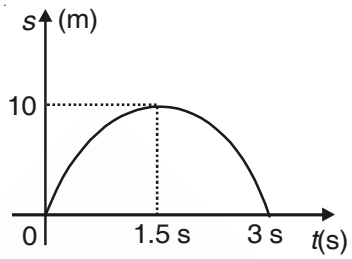
(1) 0.02 mm

(2) 0.03 mm

(3) 0.2 mm

(4) 0.3 mm

6. A particle moves rectilinearly such that its *s*-*t* graph is parabolic as shown in figure. The average velocity of the particle over a time interval between $t = 1$ s to $t = 2$ s is



(1) $\frac{10}{3}$ m/s

(2) 5 m/s

(3) 2.5 m/s

(4) Zero

7. A train accelerates from rest at a constant rate *a* for some time and then it retards to rest at the constant rate *b*. If the total distance covered by train is *l*, then the maximum velocity of train during its motion is

(1) $\left[\frac{(a+b)l}{2ab}\right]^{1/2}$

(2) $\left[\frac{(a-b)l}{2ab}\right]^{1/2}$

(3) $\left[\frac{2abl}{a+b}\right]^{1/2}$

(4) $\left[\frac{abl}{a-b}\right]^{1/2}$

8. A projectile is projected with speed *u* at an angle θ with the horizontal. Radius of curvature of trajectory at a point where velocity of projectile makes an angle α with the horizontal is

(1) $\frac{u^2\cos^2\theta}{g}$

(2) $\frac{u^2\cos^2\theta}{g\cos^3\alpha}$

(3) $\frac{u^2\cos\theta}{g\cos\alpha}$

(4) $\frac{u^2\cos^2\alpha}{g\sin\alpha}$

9. In equation,

$$\int \frac{dx}{a^2 - x^2} = a^n \ln\left(\left|\frac{a+x}{a-x}\right|\right) + c$$

x is displacement, a and c are constant of unknown dimensions. The value of n is

(1) –1

(2) 0

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

(4) 1

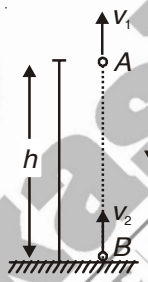
10. A particle A is thrown vertically upwards from the top of a tower of height h with speed v_1 and simultaneously another particle B is thrown vertically upwards from the ground just below the particle A with speed $v_2 (v_2 > v_1)$. Time at which the particle collide (if they collide) is

(1) $\frac{h}{v_1 + v_2}$

(2) $\frac{hv_1v_2}{v_1^2 + v_2^2}$

(3) $\frac{h}{v_2 - v_1}$

(4) $\frac{h}{v_1v_2}$



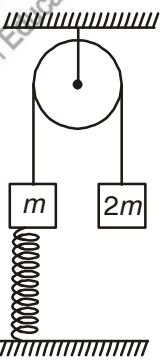
11. Acceleration of m and $2m$ just after the string is cut.

(1) 0, 0

(2) 0, $g\downarrow$

(3) $\frac{g}{2}, g\downarrow$

(4) $2g\downarrow, g\downarrow$



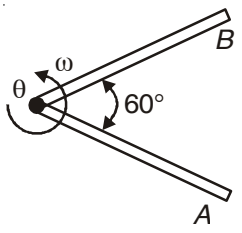
12. A rod of length $2l$ bent to the middle and rotated such that speed of both the ends A and B are v. Magnitude of relative velocity of point B with respect to A is

(1) $\sqrt{3}v$

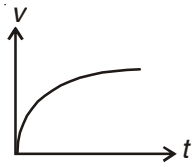
(2) Zero

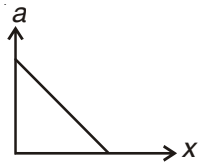
(3) $\frac{v}{2}$

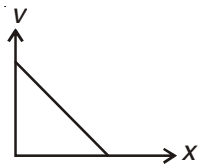
(4) v

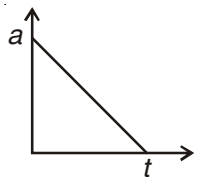


13. A particle moves with an initial velocity v_0 in a straight line. The acceleration of the particle varies with velocity as $a = -kv$, where k is a positive constant. Then which of the following graph is correct?

(1) 

(2) 

(3) 

(4) 

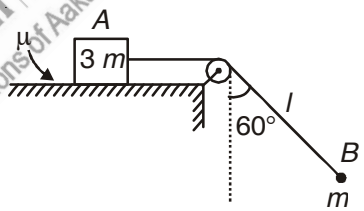
14. The minimum coefficient of friction between block A and horizontal table such that the block does not slips during entire motion of bob B of mass m released at angle 60° with vertical as shown in figure is

(1) $\mu = \frac{1}{3}$

(2) $\mu = \frac{2}{3}$

(3) $\mu = 1$

(4) $\mu = \frac{1}{2}$



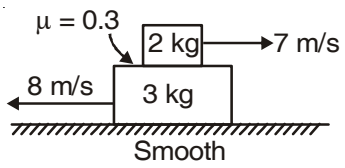
15. A block of mass 2 kg is kept on a long block of mass 3 kg and both are given velocities as shown in figure. If coefficient of friction between blocks is $\mu = 0.3$ and the surface is frictionless then time when relative motion between the blocks ceases is

(1) 1 s

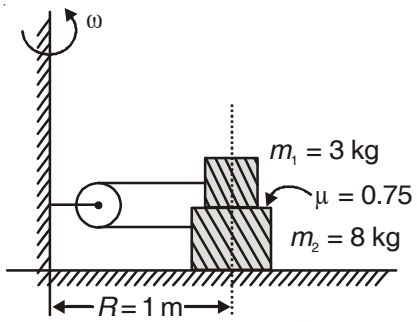
(2) 2 s

(3) 3 s

(4) 4 s



16. A system of two block as shown in figure is rotated in a horizontal circle with angular velocity ω. If masses of blocks are m_1 = 3 kg and m_2 = 8 kg, coefficient between blocks μ = 0.75 and that of between block m_2 and ground is zero, radius of circle R = 1 m then the minimum value of ω for which the relative motion between the blocks starts is



(1) ω = 1 rad/s

(2) ω = 2 rad/s

(3) ω = 3 rad/s

(4) ω = 4 rad/s

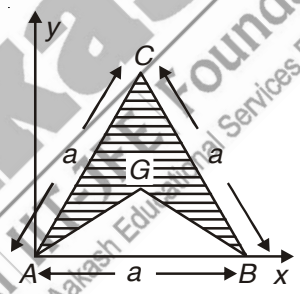
17. A uniform triangular sheet forms an equivalent triangle *ABC* with centre of mass at *G*. A triangular sheet *AGB* is cut out and remaining portion is shaded as shown in figure. If the side of triangle *ABC* is *a*, the co-ordinate of centre of mass of remaining portion is

(1) $\left(\frac{a}{2}, \frac{a}{2\sqrt{3}}\right)$

(2) $\left(\frac{a}{2}, \frac{2a}{\sqrt{3}}\right)$

(3) $\left(\frac{a}{3}, \frac{2a}{3\sqrt{3}}\right)$

(4) $\left(\frac{a}{2}, \frac{2a}{3\sqrt{3}}\right)$



18. Mark incorrect option for rectilinear motion.

(1) v decreases when $\vec{v}.\vec{a} < 0$

(2) v increases when $\vec{v}.\vec{a} > 0$

(3) v remains constant when $\vec{v}.\vec{a} = 0$

(4) v decreases when $|\vec{a}|$ decreases

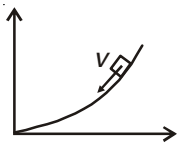
19. A particle slides down a parabolic surface having equation $y = \frac{2x^2}{3}$ the tangential acceleration of particle at x = 1

(1) 10 m/s^2

(2) 8 m/s^2

(3) 6 m/s^2

(4) 2 m/s^2



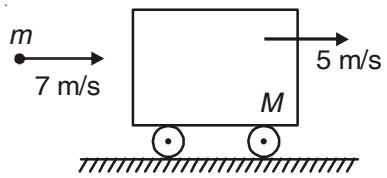
20. A large trolley of mass M moves on the horizontal frictionless surface with uniform speed 5 m/s. A ball of mass m, such that $m << M$, is thrown with speed 7 m/s on the vertical face of the trolley in the direction of motion of trolley. Speed of ball after collision, if the collision is perfectly elastic is

(1) 3 m/s rightwards

(2) 3 m/s leftwards

(3) 5 m/s rightwards

(4) 6 m/s rightwards



21. A uniform disc of radius R lies flat on a smooth horizontal plane. A similar disc of same mass and same radius spinning with the angular velocity ω_0 is carefully lowered on to the first disc. The common angular velocity of the two disc when relative motion between them ceases is (coefficient of friction between the discs is μ)

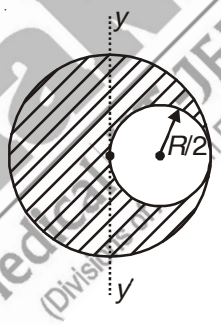
(1) $\frac{\omega_0}{2}$

(2) $\frac{\omega_0}{3}$

(3) $\frac{2\omega_0}{3}$

(4) ω_0

22. A hollow spherical cavity of radius $\frac{R}{2}$ is crafted inside a solid sphere of uniform mass density as shown. Moment of inertia of the remaining portion of sphere about axis yy', if its mass is 7m, is



(1) 1.95 mR^2

(2) 0.20 mR^2

(3) 2.85 mR^2

(4) 2.25 mR^2

23. A car accelerates uniformly from rest for 10 s, such that its final velocity is v = 10 m/s. Assuming that the wheels do not slip, the angular acceleration of the wheels of radius R = 0.5 m is

(1) 1 rad/s^2

(2) 2 rad/s^2

(3) 3 rad/s^2

(4) 4 rad/s^2

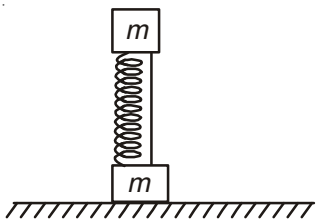
24. A system consist of two identical cubes, each of mass m linked together by a compressed weightless spring constant K. The cubes are also connected by a thread which is burnt at a certain moment. The minimum value of initial compression x_0 of spring for which lower cube bounce up after the thread in burnt is

(1) $\frac{2mg}{K}$

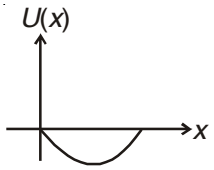
(2) $\frac{3mg}{K}$

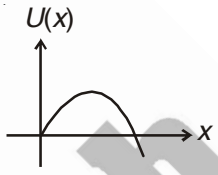
(3) $\frac{3mg}{2K}$

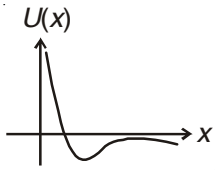
(4) $\frac{6mg}{K}$

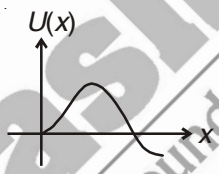


25. A particle which is constrained to move along x-axis is subjected to a force in same direction which varies with distance x of particle from the origin as $F = -kx + \alpha x^2$. Here k and α are positive constant. For $x \geq 0$, the functional form of potential energy $U(x)$ of particle is

(1) 

(2) 

(3) 

(4) 

26. The deceleration experienced by a moving motor boat, after its engine is cut-off is given by $\frac{dv}{dt} = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time t after the cut-off is

(1) $\frac{v_0}{2}$

(2) v_0

(3) $v_0 e^{-kt}$

(4) $\frac{v_0}{\sqrt{(2v_0^2 kt + 1)}}$

27. A ball is dropped into a well in which the water level is at a depth h below the top. If the speed of sound be c, then the time after which the splash is heard will be given by

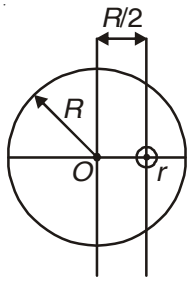
(1) $h\left[\sqrt{\frac{2}{gh}} + \frac{1}{c}\right]$

(2) $h\left[\sqrt{\frac{2}{gh}} - \frac{1}{c}\right]$

(3) $h\left[\frac{2}{g} + \frac{1}{c}\right]$

(4) $h\left[\frac{2}{g} - \frac{1}{c}\right]$

28. Find the position of centre of mass of a uniform disc of radius R from which a hole of radius r is cut out. The centre of the hole is at a distance $\frac{R}{2}$ from the centre of the disc.



(1) $\frac{Rr^2}{2(R^2 - r^2)}$ towards right of O

(2) $\frac{Rr^2}{2(R^2 - r^2)}$ towards left of O

(3) $\frac{2Rr^2}{(R^2 + r^2)}$ towards right of O

(4) $\frac{2Rr^2}{(R^2 + r^2)}$ towards left of O

29. A pendulum consists of a wooden bob of mass m and length l. A bullet of mass m_1 is fired towards the pendulum with a speed v_1. The bullet emerges out of the bob with a speed $\frac{v_1}{3}$ and the bob just completes motion along a vertical circle, then v_1 is

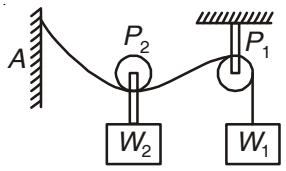
(1) $\left(\frac{m}{m_1}\right)\sqrt{5gl}$

(2) $\frac{3}{2}\left(\frac{m}{m_1}\right)\sqrt{5gl}$

(3) $\frac{2}{3}\left(\frac{m_1}{m}\right)\sqrt{5gl}$

(4) $\left(\frac{m_1}{m}\right)\sqrt{gl}$

30. In the following figure, pulley P_1 is fixed and pulley P_2 is movable. If $W_1 = W_2 = 100$ N. What is the angle of AP_2P_1? (The pulleys are frictionless)



(1) 30°

(2) 60°

(3) 90°

(4) 120°

CHEMISTRY

31. Which of the following are isoelectronic and isostructural?

$NO_3^-, CO_3^{2-}, ClO_3^-, SO_3$

(1) NO_3^-, CO_3^{2-}

(2) CO_3^{2-}, SO_3

(3) SO_3, ClO_3^-

(4) ClO_3^-, NO_3^-

32. "X" g of S is completely converted to H_2SO_4 and this is used to prepare 500 mL of 1N solution of H_2SO_4. The value of "X" is

(1) 8

(2) 16

(3) 4

(4) 32

33. Which of the following orbital has the highest number of total nodes?

(1) 3*s*

(2) 4*p*

(3) 5*d*

(4) 4*s*

34. Shortest P = O bond length is present in

(1) $H_2PO_2^-$

(2) PO_4^{-3}

(3) $H_2PO_3^{-1}$

(4) Equal in all

35. Consider the following redox reaction,

$$Cu(OH)_2(s) + N_2H_4(aq) \longrightarrow Cu(s) + N_2(g)$$

How many moles of $Cu(OH)_2$ is/are reduced by 1 mole of N_2H_4?

(1) One

(2) Two

(3) Three

(4) Four

36. Compressibility factor for one mole of a real gas at critical state is _____.

(1) 1

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

(3) $\frac{3}{8}$

(4) $\frac{8}{3}$

37. Which of the following exhibits highest first ionisation enthalpy (IE_1)?

(1) Al

(2) Ga

(3) In

(4) Tl

38. One gm of oxygen is diffused out from a container in 30 sec. What mass of hydrogen will diffuse out from the same container in the same time under identical conditions?

(1) 4 gm

(2) 1 gm

(3) 2 gm

(4) 0.25 gm

39. In a container following equilibrium exists

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

Then pressure of CO_2 can be changed by

(1) Adding more CO_2

(2) Decreasing volume

(3) Rising temperature

(4) All of these

40. Correct sequence regarding dipole moment is

(1) $H_2O > H_2O_2 > NH_3$

(2) $CH_3 - Cl > CH_3 - F > CH_3 - Br$

(3) HCl > HF > HBr

(4) p-dichlorobenzene > m-dichlorobenzene > o-dichlorobenzene

41. If M is the molecular weight of As_2S_3 then what is its equivalent weight in the following reaction?

$$As_2S_3 \longrightarrow H_3AsO_4 + H_2SO_4$$

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

(2) $\frac{M}{4}$

(3) $\frac{M}{28}$

(4) $\frac{M}{24}$

42. Which of the following is the condition for thermodynamic spontaneity?

(1) $\Delta S_{System} > 0$

(2) $\Delta S_{Surrounding} > 0$

(3) $\Delta S_{Total} > 0$

(4) $\Delta S_{Total} < 0$

43. The two oxides of sulphur have 40% and 50% of S by mass. Then it will satisfy

(1) Law of constant composition

(2) Law of multiple proportion

(3) Law of reciprocal proportion

(4) Gay Lussac's law

44. The decomposition of a certain mass of $CaCO_3$ gave 11.2 dm^2 of CO_2 at STP. What mass of KOH is required to completely neutralise the CO_2 gas? [Atomic mass of K = 39]

(1) 28 gm

(2) 42 gm

(3) 56 gm

(4) 60 gm

45. If $\left(\frac{ab}{v^2}\right)$ is negligible, then second virial coefficient B in virial equation is

(1) $\left(b - \frac{a}{RT}\right)$

(2) $\left(b - \frac{a}{RTV}\right)$

(3) $\left(b + \frac{a}{RT}\right)$

(4) $\left(b + \frac{a}{RTV}\right)$

46. Consider the following redox reaction

$$xMnO_4^- + yFe^{2+} + zH^+ \longrightarrow xMn^{2+} + yFe^{3+} + \frac{z}{2}H_2O$$

The values of x, y and z in the above reaction are respectively

(1) 2, 2, 1

(2) 5, 1, 8

(3) 2, 5, 8

(4) 1, 5, 8

47. Which of the following compound has strongest hydrogen bond?

(1) HF

(2) KHF_2

(3) H_2O

(4) $NaHCO_3$

48. Which of the following Buffer solution has the highest pH corresponding to the buffer of highest buffer capacity?

(1) HCOOH + HCOONa

(2) $CH_3COOH + CH_3COONa$

(3) $CH_3CH_2COOH + CH_3 - CH_2 - COONa$

(4) Equal in all these

49. The shortest wavelength transition in the Paschen series of H-atom occurs at 821 nm; at what wavelength does it occur in Li^{2+} ion?

(1) 273.6 nm

(2) 91.2 nm

(3) 821 nm

(4) 547.2 nm

50. Change in entropy is positive in

(1) Boiling of egg

(2) Condensation of gas

(3) Compression of ideal gas

(4) Stretching of rubber

51. Correct order regarding ionisation energy is

(1) $O > O^{-1}$

(2) $N < O$

(3) $Al > Mg$

(4) $Ba > Tl$

52. Choose the incorrect match.

	Acid	**n-factor**
(1)	H_3PO_4	3
(2)	HNO_3	1
(3)	H_2SO_4	2
(4)	H_3BO_3	3

53. The vapour density of a mixture containing NO_2 and N_2O_4 is 38.3 at 27°C. Calculate the moles of NO_2 in 100 g mixture.

(1) 0.43

(2) 0.95

(3) 1.5

(4) 2.41

54. What is the correct order of melting point?

(1) NaF < NaCl < NaBr

(2) NaF > NaCl > NaBr

(3) NaCl < NaF < NaBr

(4) None of these

55. In NO_3^- ion number of bond pairs and lone pairs of electrons on nitrogen atom are

(1) 2, 2

(2) 3, 1

(3) 1, 3

(4) 4, 0

56. Which of the following can be used as oxidant and reductant both?

(1) HNO_2

(2) SO_2

(3) CO

(4) All of these

57. When two reactants A and B are mixed to give products C and D, the reaciton quotient Q, at the initial stages of the reaction

(1) Is zero

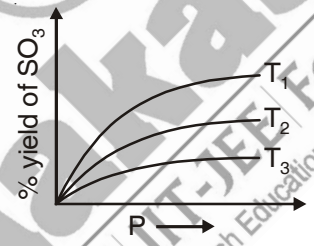
(2) Decreases with time

(3) Independent of time

(4) Increase with time

58. The preparation of $SO_3(g)$ is an exothermic process given by below reaction

$$SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$$



Which of the following is correct order?

(1) $T_3 > T_2 > T_1$

(2) $T_3 < T_2 < T_1$

(3) $T_1 = T_2 = T_3$

(4) $T_2 > T_1 > T_3$

59. The solubility of A_2X_3 is y mol dm^{-3}. Its solubility product is

(1) $6y^4$

(2) $64y^4$

(3) $36y^5$

(4) $108y^5$

60. For which reaction ΔH_r° is equal to ΔH_f° ?

(1) $CH_4(g) + 2Cl_2(g) \longrightarrow CH_2Cl_2(l) + 2HCl(g)$

(2) $Xe(g) + 2F_2(g) \longrightarrow XeF_4(g)$

(3) $2CO(g) + O_2(g) \longrightarrow 2CO_2(g)$

(4) $N_2(g) + O_3(g) \longrightarrow N_2O_3(g)$

MATHEMATICS

61. A relation R is defined on the set $B = \{2, 3\}$ such that $R = \{(a, b): a^3 - a^2b + a - b \geq 0\}$, then number of elements in R is :

(1) 1

(2) 2

(3) 3

(4) 4

62. Let $f(x)$ be a real valued function such that $f(3x) + f(3x + 12) = 2$. If $f(5x) = f(5(x + a))$, then $a =$

(1) $\frac{24}{5}$

(2) $\frac{24}{3}$

(3) 24

(4) 8

63. If $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4 + 2x^3 - 6x^2 + 7x - 9 = 0$, then the value of $(1 + \alpha^2)(1 + \beta^2)(1 + \gamma^2)(1 + \delta^2)$ is equal to

(1) 13

(2) 29

(3) 21

(4) – 21

64. Let $A+B+C \in \left(0, \frac{\pi}{2}\right)$ such that $\sin(A + B + C) = \frac{1}{\sqrt{5}}$ and $\tan(A - B - C) = \frac{1}{3}$, then the value of $2\sin A \cos A \sec 2A$ may be equal to

(1) 2

(2) 1

(3) 4

(4) 5

65. If the maximum value of $f(x) = (\sin x + \sin 2x) + (\cos x + \cos 8x)$ is 'k', then the value of $(k - 2 - \sqrt{2})$ is

(1) $\sqrt{3}$

(2) $\sqrt{2}$

(3) 0

(4) 1

66. If the graph of the function $y = f(x)$ is symmetrical about the line $x = - 4$, then

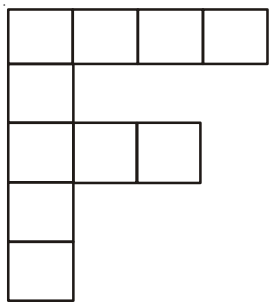
(1) $f(x - 4) = f(- x + 4)$

(2) $f(-x - 4) = f(x - 4)$

(3) $f(x + 4) = f(x - 4)$

(4) $f(- x - 4) = f(x + 4)$

67. Given letters are A,A,A,B, C,C,D,E,F,I. Then the number of ways to fill the boxes in the figure given below with 1 alphabet per box such that the vowels are always separated, is



(1) 1200

(2) 4800

(3) 2400

(4) 3600

68. Let z be a variable complex number such that $z \neq \frac{z_2}{2}$ and z_1, z_2 are two fixed distinct complex numbers. If $\arg\left(\frac{2z - z_1}{2z - z_2}\right) = \pm\frac{\pi}{2}$ and the area of the curve represented by the locus of z is A, then the value of $\left(\frac{16A}{\pi \mid z_1 - z_2 \mid^2}\right)$ is

(1) 2

(2) 1

(3) 4

(4) 16

69. If $b < 0$, $a + b > -1$ and $a - b < 1$, then the roots of the equation $x^2 + ax + b = 0$ are

(1) Real and positive

(2) Real and greater than one

(3) Of opposite signs

(4) Real and negative

70. If $f(\theta) = \frac{1 - \sin 2\theta + \cos 2\theta}{2\cos 2\theta}$, then the value of $8 \cdot f(11°) \cdot f(34°)$ is

(1) 4

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

(3) 8

(4) 2

71. If $k > 0$, $|z| = |\omega| = k$ and $\alpha = \dfrac{z - \bar{\omega}}{k^2 + z\bar{\omega}}$, then Re($\alpha$) equals

(1) $\dfrac{k}{2}$

(2) k

(3) $\dfrac{k+1}{k-1}$

(4) 0

72. If the equation $|x^2 + bx + c| = k$ has four real roots, then

(1) $b^2 - 4c > 0$ and $0 < k < \dfrac{4c - b^2}{4}$

(2) $b^2 - 4c < 0$ and $0 < k < \dfrac{4c - b^2}{4}$

(3) $b^2 - 4c > 0$ and $k > \dfrac{4c - b^2}{4}$

(4) $b^2 - 4c \geq 0$ and $k > \dfrac{4c - b^2}{4}$

73. The value of $\sum_{r=0}^{20} r(20 - r) \cdot ({}^{20}C_r)^2$ is equal to

(1) $400 \cdot {}^{39}C_{20}$

(2) $400 \cdot {}^{40}C_{19}$

(3) $400 \cdot {}^{39}C_{19}$

(4) $400 \cdot {}^{38}C_{20}$

74. $\sum\sum_{i \neq j} C_i C_j$ is equal to

(1) $\dfrac{2^{2n} - {}^{2n}C_n}{2}$

(2) $2^{2n} - {}^{2n}C_n$

(3) $2^{2n} + {}^{2n}C_n$

(4) $2^{2n} - {}^{n}C_n$

75. If $2f(x-1) - f\left(\dfrac{1-x}{x}\right) = x$, then $f(x)$ is

(1) $\dfrac{1}{3}\left\{2(1+x) + \dfrac{1}{1+x}\right\}$

(2) $2(x-1) - \dfrac{(1-x)}{x}$

(3) $x^2 + \dfrac{1}{x^2} + 4$

(4) $\dfrac{1}{4}\left\{(x+2) + \dfrac{1}{x+2}\right\}$

76. The domain of $f(x) = \sqrt{x-4-2\sqrt{x-5}} - \sqrt{x-4-2\sqrt{x-5}}$ is

(1) [–5, ∞)

(2) (–∞, 2]

(3) [5, ∞)

(4) [–5, 5]

77. If one angle of an isosceles triangle is 120° and the radius of its incircle is $\sqrt{3}$, then the area of triangle in sq. units is

(1) $7+12\sqrt{3}$

(2) $12-7\sqrt{3}$

(3) $12+7\sqrt{3}$

(4) 4π

78. There are two bags each containing *m* balls. If a man has to select equal number of balls from both the bags, then number of ways in which he can do so if he must choose at least one ball from each bag is :

(1) m^2

(2) ${}^{2m}C_m$

(3) ${}^{2m}C_m - 1$

(4) ${}^{2m}C_m - 2$

79. Sets *A* and *B* have 5 common elements then the number of elements common in power sets of *A* and *B* is

(1) 32

(2) 5

(3) 10

(4) 25

80. Let *A* represents the set of real numbers and relation *R* defined on set *A* such that $R = \{(a, b) = a^2 - 3b + 2 = 0, a \in A, b \in A\}$, then the number of elements in *R* of the form (*a*, *a*) is

(1) 1

(2) 2

(3) 0

(4) Infinitely many

81. If [ ] represents the greatest integer function then domain of $f(x) = \sqrt{\left(\log_2([x]^2 - 5[x] + 5)\right)}$ is

(1) (– ∞, ∞)

(2) (–∞, 4]

(3) (–∞, 2] ∪ [4, ∞)

(4) (–∞, 2) ∪ [4, ∞)

82. The minimum value of $f(x) = 4^{\sqrt{x^2}} - 2^{|x|} + 1 + x^4 + x^2 + \{x\}$, where { } represents fractional function, is

(1) 0

(2) 2

(3) –3

(4) 1

83. The perimeter of a triangle is 12 times the average of sines of its angles. If the side c is 2, then the angle c may be

(1) 30°

(2) 60°

(3) 90°

(4) 45°

84. The number of real solutions of the equation $\log_{1/3}\left(1+\sqrt{x}\right)+\log_{1/3}(1+x)=2$ is

(1) 2

(2) More than 2

(3) 1

(4) 0

85. The number of solution(s) of the equation $|x|^{\log_{|x|}6} + |x| = 7$ is

(1) 0

(2) 2

(3) 3

(4) 4

86. If ω, ω^2 are non-real complex cube roots of unity and $|z-2\omega| + |z-2\omega^2| = 2\sqrt{3}$. If $I_m(z)$ represents imaginary part of z then the maximum value of $I_m(z)$ is

(1) 1

(2) 3

(3) $\sqrt{3}$

(4) $-\sqrt{3}$

87. If $x^{k+1} + yx^k + y^kx + y^{k+1}$ is divisible by $x^2 + 2xy + y^2$ then

(1) k is negative real number

(2) k is even natural number

(3) k is odd positive integer

(4) k is even integer

88. Let $|z_1| \le 1$ and the distance of z_2 from origin is 2. If $|z_1 + z_2 + 3 + 4i| = 8$ then $|z_1|$ is equal to

(1) 1

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

(3) $\frac{1}{3}$

(4) $\frac{1}{4}$

89. The greatest value of the expression $\frac{1}{4x^2+2x+1}$ is

(1) $\frac{4}{3}$

(2) $\frac{5}{2}$

(3) $\frac{14}{13}$

(4) $\frac{2}{5}$

90. If $0 < a < b$, then the solution of the equation $x^2 + (a + 2b)\, x + 2ab < 0$ is

(1) $(-a, -2b)$

(2) $[-a, -2b]$

(3) $(-\infty, -2b) \cup (-a, \infty)$

(4) $(-2b, -a)$

❑ ❑ ❑

Aakash
Medical | IIT-JEE | Foundations
(Divisions of Aakash Educational Services Pvt. Ltd.)
Regd. Office : Aakash Tower, 8, Pusa Road, New Delhi-110005. Ph.: 011-47623456

Success Achiever for JEE (Main)-2018

Test-1 (Online)

(ANSWER)

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

Aakash
Medical | IIT-JEE | Foundations
(Divisions of Aakash Educational Services Pvt. Ltd.)
Regd. Office : Aakash Tower, 8, Pusa Road, New Delhi-110005. Ph.: 011-47623456

Success Achiever for JEE (Main)-2018

Test-1 (Online)

[Hint & Solution]

PHYSICS

1. Answer (4)

Error in area, $\Delta A = lb\left(\frac{\Delta l}{l} + \frac{\Delta b}{b}\right)$

$$= 12.5 \times 7.5\left(\frac{0.1}{12.5} + \frac{0.1}{7.5}\right) = 2\ m^2$$

Number of significant figures in area

= least number of significant figures in l or b

= 2

So area = 12.5 × 7.5 = 93.75 has to be rounded of till 2 significant figures

i.e., Area, A = 94

2. Answer (2)

Say [Work] = $[F^a v^b f^c]$

$\Rightarrow$ $[ML^2 T^{-2}] = [MLT^{-2}]^a [LT^{-1}]^b [T^{-1}]^c$

Solving , $a = 1$, $b = 1$, $c = -1$

So, $[W] = [F\ v\ f^{-1}]$

3. Answer (3)

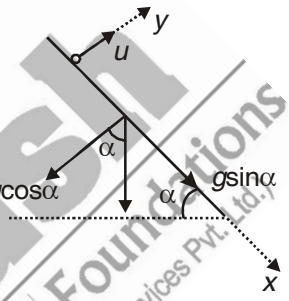
Area under $a - t$ graph = change in velocity as till time t_4, area is positive so velocity is increasing. So at t_4 velocity is maximum.

4. Answer (3)

$u_y = u$

$a_y = -g\cos\alpha$

$$T = \frac{2u_y}{|a_y|} = \frac{2u}{g\cos\alpha} = \frac{2u}{g}\sec\alpha$$



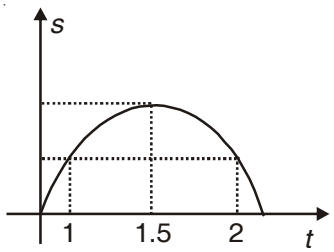
5. Answer (4)

Least count of vernier callipers

$$= \left(\frac{MSD - VSD}{MSD}\right) \times 1\,mm$$

$$= \left(\frac{20 - 14}{20}\right) \times 1\,mm = 0.3\ mm$$

6. Answer (4)

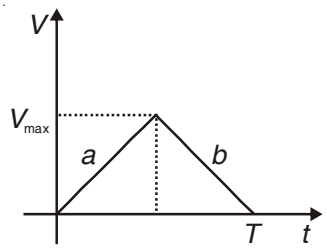


As the s - t graph is parabolic, displacements of particle at t = 1 and t = 2s are equal is displacement between t = 1s

So t = 2s is zero.

Average velocity between t = 1s to t = 2s is zero.

7. Answer (3)



$$V_{max} = \left(\frac{ab}{a+b}\right)T$$

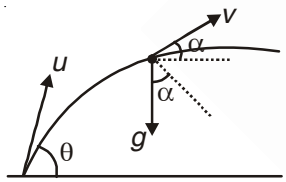
$$I = \frac{1}{2}\left(\frac{ab}{a+b}\right)T^2$$

$$T = \left[\frac{2I}{\left(\frac{ab}{a+b}\right)}\right]^{1/2}$$

So, $V_{max} = \left(\frac{ab}{a+b}\right)\left[\frac{2I}{\frac{ab}{a+b}}\right]^{1/2}$

$$= \left[\frac{2abI}{a+b}\right]^{1/2}$$

8. Answer (2)



When velocity v makes angle α with horizontal

$v\cos\alpha = u\cos\theta \Rightarrow v = u\cos\theta\sec\alpha$

Radius of curvature

$$r = \frac{v^2}{a_c}$$

$$= \frac{u^2\cos^2\theta\sec^2\alpha}{g\cos\alpha}$$

$$\Rightarrow r = \frac{u^2}{g}\frac{\cos^2\theta}{\cos^3\alpha}$$

9. Answer (1)

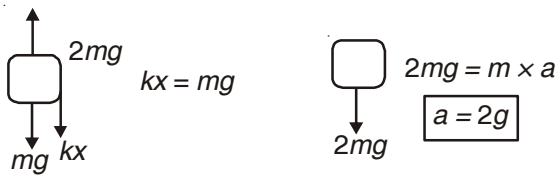
Dimension of LHS = $[L^{-1}]$

Dimension of RHS = $[L^n]$

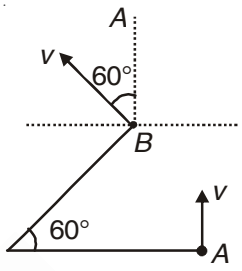
By principle of horizontality $n = -1$

10. Answer (3)

11. Answer (4)



12. Answer (4)

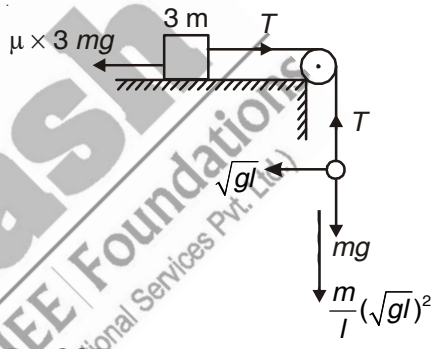


$$|\vec{v}_{AB}| = \sqrt{v^2 + v^2 - 2v\cdot v\cos 60°}$$

$$= v$$

13. Answer (3)

14. Answer (2)



By *COE*,

$$mgl(1-\cos 60°) = \frac{1}{2}mv^2$$

$$\Rightarrow \frac{mv^2}{l} = ms$$

Tension in string when bob is at bottom most *pt*,

$$T = mg + \frac{mv^2}{l} = 2\,mg$$

For equilibrium of block

$\mu \times 3mg = T = 2mg$

$$\mu = \frac{2}{3}$$

15. Answer (3)

For 2kg blocks

$v = 7 - 0.3 \times gt$

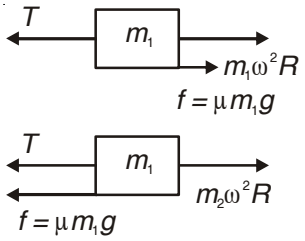
For 3 kg block,

$$v = -8 + 0.3 \times \frac{2}{3}gt$$

Solutions $15 = 0.3 \times \frac{5}{3} \times 10 \times t$

$\Rightarrow t = 3$ s

16. Answer (3)

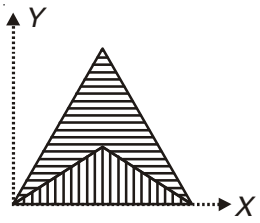


For block m_1, $T = m_1\omega^2R + \mu m_1 g$

For block m_2, $T = m_2\omega^2R + \mu m_1 g$

So, $\omega = \sqrt{\dfrac{2\mu m_1 g}{R(m_2 - m_1)}} = 3$ rad/s

17. Answer (4)



$m_1 = +3m$, $(x_1, y) \equiv \left(\dfrac{a}{2}, \dfrac{a}{2\sqrt{3}}\right)$

$m_2 = -m$, $(x_2, x_1) \equiv \left(\dfrac{a}{2}, \dfrac{a}{6\sqrt{3}}\right)$

$x_{cm} = \dfrac{a}{2}$

$y_{cm} = \dfrac{3m \times \frac{a}{2\sqrt{3}} + (-m)\frac{a}{6\sqrt{3}}}{3m + (-m)} = \dfrac{2a}{3\sqrt{3}}$

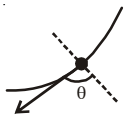
18. Answer (4)

v might increase when $|\vec{a}|$ decrease.

19. Answer (2)

$\tan\theta = \dfrac{dy}{dx} = \dfrac{4 \times x}{3}$

$\tan\theta = \dfrac{4}{3}$



at = $g\sin\theta = 10 \times \dfrac{4}{5} = 8 \text{m/s}^2$

20. Answer (1)

In case when collision is perfectly elastic and $m_1 << m_2$

$v_1 = 2u_2 = u_1$

$= 2 \times 5 - 7 = +3$ m/s

21. Answer (1)

The torques due to friction of discs are initial

So the total angular momentum remains conserved

So, $I_1\omega_1 = I_2\omega_2$

So, $\dfrac{mR^2}{2} \times \omega_0 + 0 = 2 \times \dfrac{mR^2}{2} \times \omega \Rightarrow \omega = \dfrac{\omega_0}{2}$

22. Answer (3)

$M_1 = M$, $M_2 = -M$

Net MI, $\dfrac{1}{yy'} = \dfrac{2}{5}(8M)R^2 - \left[\dfrac{2}{5}(M)\left(\dfrac{R}{2}\right)^2 + (M)\left(\dfrac{R}{2}\right)^2\right]$

$= \dfrac{2}{5} \times 8mR^2 - \dfrac{2}{5} \times \dfrac{1}{4}mR^2 - \dfrac{mR^2}{4}$

$= mR^2\left[\dfrac{16}{5} - \dfrac{1}{10} - \dfrac{1}{4}\right]$

$= mR^2 \times \left[\dfrac{64 - 2 - 5}{20}\right] = \dfrac{57}{20}mR^2$

$= 2.85\ mR^2$

23. Answer (2)

Initial angular velocity, $\omega_1 = 0$

Final angular velocity, $\omega = \dfrac{v}{R} = \dfrac{10}{1/2} = 20$ rad/s

As, $\omega = \omega_0 + \alpha t$

$\Rightarrow$ $20 = 0 + \alpha \times 10$

$\Rightarrow$ $\alpha = 2$ rad/s^2

24. Answer (2)

$\dfrac{1}{2} \times x^2 - \dfrac{1}{2}K(x_0)^2 + mg(x + x_0) = 0$

$mg = kx$

$(x - x_0) = -\dfrac{2mg}{K}$

$x_0 = \dfrac{3mg}{K}$

25. Answer (4)

$\int du = -\int F.dx = \dfrac{kx^2}{2} - \dfrac{\alpha x^4}{4}$

$F = 0$ at $x = 0$

26. Answer (4)

$$\frac{dv}{dt} = -kv^3$$

or $\frac{dv}{v^3} = -kdt$ or $\int_{v_0}^{v} \frac{dv}{v^3} = \int_0^t -kdt$

or $\left[\frac{1}{-2v^2}\right]_{v_0}^{v} = -kt$ or $-\frac{1}{2v^2} + \frac{1}{2v_0^2} = -kt$

or $v^2 = \frac{v_0^2}{1+2v_0^2kt}$ or $v = \frac{v_0}{\sqrt{1+2v_0^2kt}}$

27. Answer (1)

Time of fall $= \sqrt{\frac{2h}{g}}$

Time taken by the sound to come out $= \frac{h}{c}$

Total time $= \sqrt{\frac{2h}{g}} + \frac{h}{c} = h\left[\sqrt{\frac{2}{gh}} + \frac{1}{c}\right]$

28. Answer (2)

For a disc, mass is proportional to surface area. So mass of cut portion : $m_1 = k\pi r^2$.

Mass of remaining portion : $m_2 = k\pi(R^2 - r^2)$

Applying $m_1x_1 = m_2x_2$, where $x_1 = \frac{R}{2}$, and solving to get

$$x_2 = \frac{Rr^2}{2(R^2 - r^2)}$$

29. Answer (2)

Apply the law of conservation of momentum.

$$m_1v_1 = m_1\frac{v_1}{3} + mv \quad \text{or} \quad v = \frac{2m_1v_1}{3m}$$

To describe a vertical circle, v should be $\sqrt{5gl}$

So, $\frac{2m_1v_1}{3m} = \sqrt{5gl}$ or $v_1 = \left(\frac{m}{m_1}\right)\left(\frac{3}{2}\right)\sqrt{5gl}$

30. Answer (4)

Let the tension in the string AP_2 and P_2P_1 be T. Considering the force on pulley P_1, we get $T = W_1$

$\angle AP_2P_1 = 2\theta$

Resolving tension in horizontal and vertical directions and considering the forces on pulley P_2, we get $2T\cos\theta = W_2$

or $2W_1\cos\theta = W_2$ or $\cos\theta = \frac{1}{2}$, $\theta = 60°$

So, $\angle AP_2P_1 = 2\theta = 120°$

CHEMISTRY

31. Answer (1)

CO_3^{2-} are both triangular planar and have 32 electrons each.

32. Answer (1)

Mole of S = Mole of $H_2SO_4 = \frac{1}{4}$

Wt. of sulphur = 8 g.

33. Answer (3)

In 5*d,* total nodes are 4.

34. Answer (1)

Due to least number of resonating structures.

35. Answer (2)

36. Answer (3)

$$Z_c = \frac{P_c V_c}{RT_c} = \frac{3}{8}$$

37. Answer (4)

Due to poor screening of 4f electrons in Tl

38. Answer (4)

39. Answer (3)

K_P can be increased by increase in temperature in this case.

40. Answer (2)

μ of H_2O_2 > μ of H_2O

41. Answer (3)

n-factor of As_2S_3 = 28

42. Answer (3)

43. Answer (2)

For one oxide = $\frac{\%O}{\%S} = \frac{60}{50} = \frac{6}{4}$

For other oxide = $\frac{\%O}{\%S} = \frac{50}{50} = 1$

These two ratio prove law of multiple proportion.

44. Answer (3)

45. Answer (1)

46. Answer (4)

$$MnO_4^- + 5Fe^{2+} + 8H^7 \longrightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$$

47. Answer (2)

Strongest H-bond exists in KHF_2

48. Answer (3)

At maximum buffer capacity

$pH = pK_a$

49. Answer (2)

91.2 nm is the shortest wavelength in Paschen series of Li^{2+}.

50. Answer (1)

ΔS is positive in boiling of egg.

51. Answer (1)

IE_1 of O > O^{-1}.

52. Answer (4)

n-factor for H_3BO_3 is 1.

53. Answer (1)

Molar mass of mixture of NO_2 and N_2O_4

= 38.3 × 2 = 76.6

Let a g of NO_2 is present in 100 g mixture

Moles of NO_2 + Moles of N_2O_4 = Moles of mixture

$$\frac{a}{46} + \frac{100-a}{92} = \frac{100}{76.6}$$

a = 20.10 g

Moles of NO_2 in mixture = $\frac{20.10}{46}$ = 0.437

54. Answer (2)

Bigger the anion greater will be covalent character and lesser will be ionic character, hence lower will be melting point for compound with bigger anion.

55. Answer (4)

56. Answer (4)

57. Answer (4)

From initial stage reaction quotient increases with time.

58. Answer (1)

The formation of SO_3 is exothermic, hence at high temperature backward reaction will proceed to give lower yield.

59. Answer (4)

K_{sp} of A_2X_3 = $2^2 \times 5^2 \times 3^3 \times 5^3$

= 1085^5 = $108y^5$

60. Answer (2)

MATHEMATICS

61. Answer (3)

The given equation can be written as

$a^3 - a^2b + a - b \geq 0$

$\Rightarrow a^2(a - b) + 1(a - b) \geq 0$

$\Rightarrow (a - b)(a^2 + 1) \geq 0$

$\Rightarrow a \geq b \Rightarrow R = \{(2, 2), (3, 3), (3, 2)\}$

62. Answer (1)

$f(3x) + f(3x + 12) = 2$ …(i)

Replacing x by $x + 4$

$f(3x + 12) + f(3x + 24) = 2$ …(ii)

Subtracting (ii) from (i)

$f(3x) = f(3x + 24)$

$\Rightarrow f(5x) = f(5x + 24)$

$\Rightarrow a = \frac{24}{5}$

63. Answer (2)

Using transformation $y = x^2$ in given equation

We gets

$y^4 - 16y^3 - 10y^2 + 59y + 81 = 0$

Roots of this equation are $\alpha^2, \beta^2, \gamma^2, \delta^2$

$\Sigma\alpha^2 = 16, \Sigma\alpha^2\beta^2 = -10, \Sigma\alpha^2\beta^2\gamma^2 = -59,$

$\alpha^2\beta^2\gamma^2\delta^2 = 81$

$(1 + \alpha^2)(1 + \beta^2)(1 + \gamma^2)(1 + \delta^2)$

$= 1 + \Sigma\alpha^2 + \Sigma\alpha^2\beta^2 + \Sigma\alpha^2\beta^2\gamma^2 + \alpha^2\beta^2\gamma^2\delta^2$

$= 1 + 16 - 10 - 59 + 81 = 29$

64. Answer (2)

$\sin(A + B + C) = \frac{1}{\sqrt{5}}$

$\Rightarrow \tan(A + B + C) = \frac{1}{2}$

Also $2\sin A\cos A\sec 2A = \frac{\sin 2A}{\cos 2A} = \tan 2A$

$\tan 2A = \tan((A + B + C) + (A - B - C))$

$= \frac{\tan(A+B+C) + \tan(A-B-C)}{1 - \tan(A+B+C)\tan(A-B-C)} = \frac{\frac{1}{2} + \frac{1}{3}}{1 - \frac{1}{2} \times \frac{1}{3}} = 1$

$\Rightarrow \tan 2A = 1$

65. Answer (3)

$f(x)$ can be written as

$f(x) = (\sin x + \cos x) + (\sin 2x) + (\cos 8x)$

$= \sqrt{2}\left(\sin\left(x + \frac{\pi}{4}\right)\right) + \sin 2x + \cos 8x$

Clearly all the terms are maximum at $x = \frac{\pi}{4}$

$\Rightarrow k = \sqrt{2}(1) + 1 + 1 = 2 + \sqrt{2}$

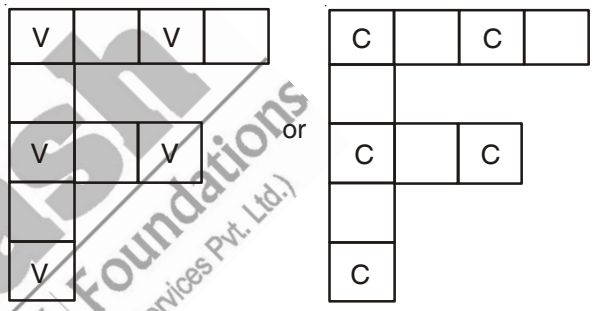
$\Rightarrow k - 2 - \sqrt{2} = 0$

66. Answer (2)

If $y = f(x)$ is symmetrical about the line x = a, then $f(a - x) = f(a + x)$

Hence, $f(-4 - x) = f(-4 + x)$

67. Answer (3)



Hence, number of ways = $2 \times \frac{5!}{3!} \times \frac{5!}{2!} = 2400$

68. Answer (2)

Clearly the locus of z_1 is a circle having $\frac{z_1}{2}, \frac{z_2}{2}$ as ends of the diameter of circle.

$\Rightarrow$ Radius of circle = $\frac{1}{2}\left|\frac{z_1}{2} - \frac{z_2}{2}\right| = \frac{|z_1 - z_2|}{4} = r$

$A = \pi(r^2) = \pi\left(\frac{|z_1 - z_2|^2}{16}\right)$

$\Rightarrow \left(\frac{16A}{\pi|z_1 - z_2|^2}\right) = 1$

69. Answer (3)

Given $b < 0$, $1 + a + b > 0$, $1 - a + b > 0$

Let $f(x) = x^2 + ax + b$

$f(1) = 1 + a + b > 0$

$f(0) = b < 0$

$f(-1) = 1 - a + b > 0$

Hence, one root lies between (– 1, 0) and the other between (0, 1)

70. Answer (1)

$$f(\theta)=\frac{1-\sin 2\theta+\cos 2\theta}{2\cos 2\theta}$$

$$=\frac{(1+\cos 2\theta)-\sin 2\theta}{2\cos 2\theta}$$

$$=\frac{2\cos^2\theta-2\sin\theta\cos\theta}{2[\cos^2\theta-\sin^2\theta]}$$

$$=\frac{\cos\theta[\cos\theta-\sin\theta]}{(\cos^2\theta-\sin^2\theta)}$$

$$f(\theta)=\frac{\cos\theta}{\cos\theta+\sin\theta}=\frac{1}{(1+\tan\theta)}$$

$$\therefore\quad f(11°)\cdot f(34°)=\frac{1}{(1+\tan 11°)}\times\frac{1}{(1+\tan 34°)}=\frac{1}{2}$$

71. Answer (4)

$\because$ $k>0$, $|z|=|\omega|=k$ and $\alpha=\dfrac{z-\bar{\omega}}{k^2+z\bar{\omega}}$

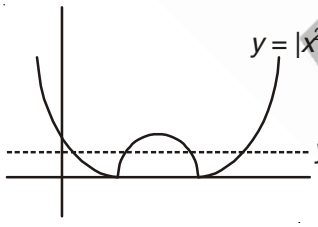
$$\text{Re}(\alpha)=\frac{\alpha+\bar{\alpha}}{2}=\frac{\dfrac{z-\bar{\omega}}{k^2+z\bar{\omega}}+\dfrac{\bar{z}-\omega}{k^2+\bar{z}\omega}}{2}$$

$$=\frac{\begin{matrix}k^2z+|z|^2\omega-k^2\bar{\omega}-\bar{z}|\omega|^2\\ +k^2\bar{z}-\omega k^2+|z|^2\bar{\omega}-z|\omega|^2\end{matrix}}{2(k^2+z\bar{\omega})(k^2+\bar{z}\omega)}$$

$$=\frac{0}{2(k^2+z\bar{\omega})(k^2+\bar{z}\omega)}=0$$

72. Answer (1)

Equation $|x^2+bx+c|=k$ has four real roots if



For this graph $b^2-4c>0$ and $0<k<\dfrac{4c-b^2}{4}$

73. Answer (4)

$$\sum_{r=0}^{20} r(20-r)\cdot({}^{20}C_r)^2$$

$$=\sum_{r=0}^{20} r\cdot{}^{20}C_r(20-r)\cdot{}^{20}C_{20-r}$$

$$=\sum 20\cdot{}^{19}C_{r-1}\cdot 20\cdot{}^{19}C_{19-r}$$

$$=400\sum_{r=0}^{20}{}^{19}C_{r-1}\cdot{}^{19}C_{19-r}$$

$$=400\cdot{}^{38}C_{18}$$

$$=400\cdot{}^{38}C_{20}$$

74. Answer (2)

$$\sum_{i\neq j}\sum {}^nC_i\,{}^nC_j=\sum_{i=0}^{n}\sum_{j=0}^{n}{}^nC_i\cdot{}^nC_j-\sum_{i=0}^{n}({}^nC_i)^2$$

$$=2^{2n}-{}^{2n}C_n$$

75. Answer (1)

$$2f(x-1)-f\left(\frac{1}{x}-1\right)=x \qquad \ldots(i)$$

Replace $x\to\dfrac{1}{x}$

$$2f\left(\frac{1}{x}-1\right)-f(x-1)=\frac{1}{x} \qquad \ldots(ii)$$

From [2(i) + (ii)]

$$3f(x-1)=2x+\frac{1}{x}$$

$$f(x-1)=\frac{1}{3}\left[2x+\frac{1}{x}\right]$$

Again, By $x\to x+1$

$$f(x)=\frac{1}{3}\left[2(x+1)+\frac{1}{x+1}\right]$$

76. Answer (3)

$$f(x)=\sqrt{x-4-2\sqrt{x-5}}-\sqrt{x-4+2\sqrt{x-5}}$$

$$=\sqrt{(\sqrt{x-5})^2+(1)^2-2\sqrt{x-5}}$$

$$-\sqrt{(\sqrt{x-5})^2+(1)^2+2\sqrt{x-5}}$$

$$f(x)=\left|\sqrt{x-5}-1\right|-\left|\sqrt{x-5}+1\right|$$

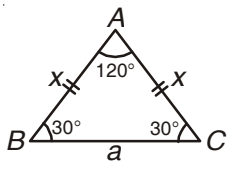
For domain : $x-5\geq 0$

$x\geq 5$

77. Answer (3)

Let the two equal sides be x. By applying the sine rule in ΔABC, we get

$$\frac{x}{\sin 30°}=\frac{a}{\sin 120°}$$



$$\Rightarrow\quad a=x\sqrt{3}$$

$$\Rightarrow\quad \Delta=\frac{1}{2}(x)(x)\sin 120°$$

$$\Delta=\frac{\sqrt{3}}{4}x^2 \qquad \ldots(i)$$

Also, $\sqrt{3}=\dfrac{\Delta}{s}=\dfrac{\sqrt{3}x^2}{4\dfrac{(2x+a)}{2}}$

$$\Rightarrow\quad x^2=2(2x+a)$$

$$\Rightarrow\quad x^2=4x+2a$$

$$\Rightarrow\quad x^2=4x+2(x\sqrt{3})$$

$$\Rightarrow\quad x=4+2\sqrt{3}$$

$\therefore$ From (i)

$$\Delta = \frac{\sqrt{3}}{4}(4+2\sqrt{3})^2$$

$$= \sqrt{3}(7+4\sqrt{3})$$

$$= 12+7\sqrt{3}$$

78. Answer (3)

Total ways

$= {}^{m}C_1 \cdot {}^{m}C_1 + {}^{m}C_2 \cdot {}^{m}C_2 + \ldots + {}^{m}C_m \cdot {}^{m}C_m$

$= {}^{2m}C_m - 1$

79. Answer (1)

The number of elements common to power sets of A and B.

= Number of subsets of elements common to sets A and B

$= 2^5 = 32$

80. Answer (2)

For aRa

$\Rightarrow a^2 - 3a + 2 = 0$

$\Rightarrow a = 1, 2$

Hence, two elements are possible.

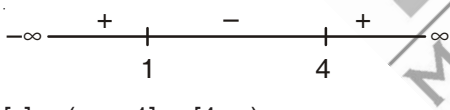
81. Answer (4)

For domain, $\log_2([x]^2 - 5[x] + 5) \geq 0$

$\Rightarrow [x]^2 - 5[x] + 5 \geq 1$

$\Rightarrow [x]^2 - 5[x] + 4 \geq 0$

$([x] - 1)([x] - 4) \geq 0$



$\Rightarrow [x] \in (-\infty, 1] \cup [4, \infty)$

$\Rightarrow x \in (-\infty, 2) \cup [4, \infty)$

82. Answer (4)

As $\sqrt{x^2} = |x|$

Let $y = 4^{|x|} - 2^{|x|} + 1 = \left(2^{|x|} - \frac{1}{2}\right)^2 + \frac{3}{4}$

Clearly $y_{min} = 1$, at $x = 0$

Also at $x = 0$, $x^4 + x^2 + \{x\}$ is minimum

$\Rightarrow$ The minimum value of

$f(x) = 1 + 0 + 0 + 0 = 1$

83. Answer (1)

$$\frac{12(\sin A+\sin B+\sin C)}{3} = a+b+c$$

$$= 4(\sin A+\sin B+\sin C) = 2R(\sin A+\sin B+\sin C)$$

$$\boxed{2R=4}$$

$$\sin C = \frac{C}{2R} = \frac{2}{4} = \frac{1}{2}$$

84. Answer (4)

$$\log_{\frac{1}{3}}\left(1+\sqrt{x}\right)(1+x) = 2$$

$$(1+x)\left(1+\sqrt{x}\right) = \frac{1}{9}$$

$$x^{\frac{3}{2}} + x + x^{\frac{1}{2}} + \frac{8}{9} = 0$$

No solution

85. Answer (1)

Clearly the equation can be written as $6 + |x| = 7$ $\Rightarrow |x| = 1$ but due to property of log function $|x| \neq 1$. Hence number of solution = 0.

86. Answer (3)

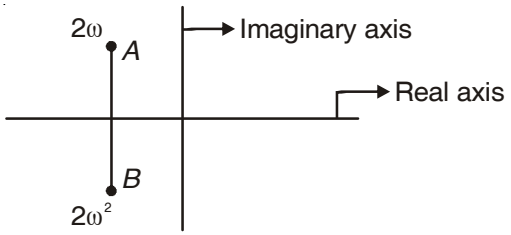
$|z - 2\omega| + |z - 2\omega^2| = 2\sqrt{3}$

Let $\omega = \frac{-1+i\sqrt{3}}{2}, \omega^2 = \frac{-1-i\sqrt{3}}{2}$

$$|2\omega - 2\omega^2| = 2\left|\frac{-1+i\sqrt{3}}{2} - \frac{-1-i\sqrt{3}}{2}\right| = 2\sqrt{3}$$

As $|2\omega - 2\omega^2| = 2\sqrt{3}$

Hence, z lies on the line joining 2ω, $2\omega^2$



As A = $2\omega = (-1+i\sqrt{3})$

Hence, maximum value of Im(z) = $\sqrt{3}$

87. Answer (3)

$= x^{k+1} + yx^k + y^k x + y^{k+1}$

Let $a = (x + y)(x^k + y^k)$

$b = x^2 + 2xy + y^2 = (x + y)^2$

If a is divisible by b then k is odd positive integer.

88. Answer (1)

Let $|z_1| \le 1$, $|z_2| = 2$

$|z_1 + z_2 + 3 + 4i| = 8$

$\Rightarrow \quad 8 \le |z_1| + |z_2| + |3 + 4i|$

$\Rightarrow \quad |z_1| \ge 1$, but given that $|z_1| \le 1$

Hence $|z_1| = 1$

89. Answer (1)

$y = \dfrac{1}{4x^2+2x+1}$ is maximum when

$4x^2 + 2x + 1$ is minimum

Minimum value of $4x^2 + 2x + 1$ is $\dfrac{3}{4}$

Hence, $y_{max} = \dfrac{1}{\frac{3}{4}} = \dfrac{4}{3}$

90. Answer (4)

$x^2 + ax + 2bx + 2ba < 0$

$(x + a)(x + 2b) < 0$

$x \in (-2b, -a)$

❑ ❑ ❑