Aakash
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Time : 3 Hrs. **MM : 360**

MOCK TEST PAPER

for

JEE (Main)-2016

GENERAL 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.

(v) **Pattern of the Questions :**

Section – I : Straight Objective Type Questions; **Section – II : Assertion – Reason Type Questions**

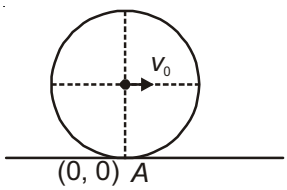
[PHYSICS]

SECTION - I
Straight Objective Type Questions

This section contains 25 multiple choice questions numbered 1 to 25. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. A wheel of radius r rolls without slipping along the x-axis with constant speed v_0 as shown in the figure. Speed of a point A on the rim of the wheel at any time t, which starts from the origin (0, 0) at time $t = 0$ is



(1) $2v_0 \cos\left(\frac{v_0 t}{2r}\right)$

(2) $2v_0 \sin\left(\frac{v_0 t}{r}\right)$

(3) $2v_0 \sin\left(\frac{v_0 t}{2r}\right)$

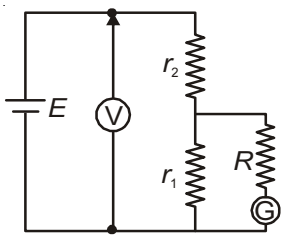
(4) $2v_0 \cos\left(\frac{v_0 t}{r}\right)$

2. Value of g is 980 cm/s^2. Find its value in km/h^2

(1) 1.27×10^5 (2) 10^5

(3) 2×10^5 (4) 7×10^5

3. In an experiment the following values are observed for the circuit arrangement shown in the figure. Reading of galvanometer is 20 divisions and that of voltmeter is 2 volts. (Given $r_1 = 2\ \Omega$, $r_2 = 10^5\ \Omega$, $R = 900\ \Omega$ galvanometer resistance $100\ \Omega$). Determine current sensitivity



(1) 4×10^{-5} division per ampere

(2) 5×10^8 division per ampere

(3) 5×10^6 division per ampere

(4) 4×10^{-8} division per ampere

4. The relative velocity of car *A* with respect to car *B* is $30\sqrt{2}$ m/s due North-East. The velocity of car *B* is 20 m/s due south, relative velocity of car *C* with respect to car *A* is $10\sqrt{2}$ m/s due North-West. The speed of car *C* and the direction (in terms of angle it makes with the east) is

(1) $10\sqrt{2}$ m/s, 135°

(2) $10\sqrt{2}$ m/s, 45°

(3) $20\sqrt{2}$ m/s, 45°

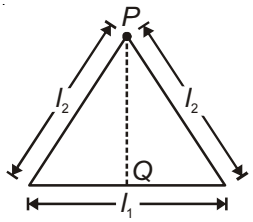
(4) $20\sqrt{2}$ m/s, 135°

5. The temperature of 100 g of water is to be raised from 24°C to 90°C by adding steam to it. Calculate the mass of steam required for this purpose. (Given specific rate of water is 1 cal/g/°C, latent heat of vaporization is 540 cal/g)

(1) 10 g (2) 74 g

(3) 47 g (4) 12 g

6. An isosceles triangle is formed with a thin rod of length l_1 and coefficient of linear expansion α_1 as the base and two thin rods each of length l_2 and coefficient of the linear expansion α_2 as the two sides. If the distance between the apex and the midpoint of the base remains unchanged as the temperature varied. Find the ratio of $\frac{l_1}{l_2}$



(1) $2\sqrt{\frac{\alpha_1}{\alpha_2}}$ (2) $\sqrt{\frac{\alpha_1}{2\alpha_2}}$

(3) $2\sqrt{\frac{\alpha_2}{\alpha_1}}$ (4) $\sqrt{\frac{2\alpha_2}{\alpha_1}}$

7. Calculate the pressure of hydrogen gas in a cylinder of capacity 10 litre, given that the total kinetic energy of translation is 7.5×10^3 J (1 atm pressure = 10^5 N/m^2)

(1) 5×10^5 N/m^2

(2) 2.5×10^5 N/m^2

(3) 3×10^5 N/m^2

(4) 4.5×10^5 N/m^2

8. The density of air at NTP is 1.293 g/l and $\gamma = 1.36$. Calculate the frequency of a tuning fork which emits sound of wavelength 66.5 cm at 17°C.

(1) 403 Hz (2) 342 Hz

(3) 412 Hz (4) 506 Hz

9. The sound level at point is increased by 30 dB. Approximately by what factor is the pressure amplitude increased?

(1) 12 (2) 21

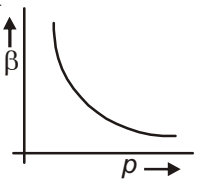
(3) 23 (4) 32

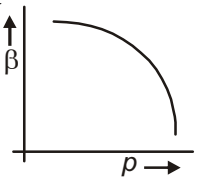
10. When a ray of light in air enters a liquid, it is found that the angle between the incident and the refracted ray is 150° and the angle between the reflected and refracted ray is 60°. Find the refractive index of the liquid.

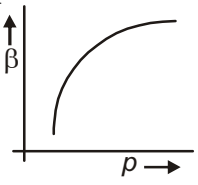
(1) 1.37 (2) 1.24

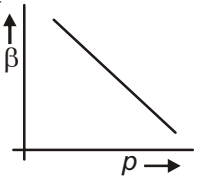
(3) 1.44 (4) 1.11

11. Which of the following graph correctly represent the variation of $\beta = -\left(\frac{dv}{dp}\right)\Big/v$ with *p* (pressure) for an ideal gas at constant temperature?

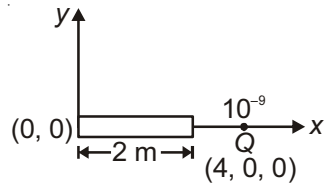
(1)


(2)


(3)


(4)


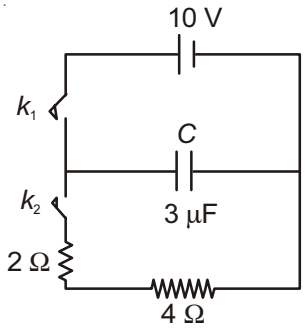
12. A thin uniformly charged rod having charge q = 2 C and length L = 2 m is placed along the x-axis and its one end is at the origin of coordinate system. A point charge $Q = 10^{-9}$ C is placed at the point (4, 0, 0). Find the electrostatic potential energy of the system



(1) 10 (ln 2) J (2) 9 (ln 2) J

(3) 9 (ln 4) J (4) 10 (ln 4) J

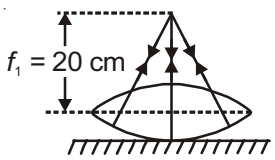
13. A capacitor of capacitance 3 μF is first charged by connecting it across a 10 V battery by closing key k_1, then it is allowed to get discharged through 2 Ω and 4 Ω resistors by closing the key k_2. The total energy dissipated in the 4 Ω resistor is equal to



(1) 0.75 mJ (2) 0.15 mJ

(3) 0.10 mJ (4) 0.05 mJ

14. A thin equiconvex glass lens (μ = 3/2) is placed on a horizontal plane mirror and a pin held 20 cm above the lens coincides in position with its own image. The space between the lens and mirror is filled with water (μ = 4/3) and then to coincide with its own image as before, the pin has to be raised until its distance from the lens is 27.5. Find the radius of curvature of lens



(1) 52.7 cm (2) 27.5 cm

(3) 42.4 cm (4) 24.4 cm

15. A 75 MHz carrier wave having an amplitude of 50 V is modulated by a 3 kHz audio signal having an amplitude of 20 V. Determine the modulation factor

(1) 2.5 (2) 0.04

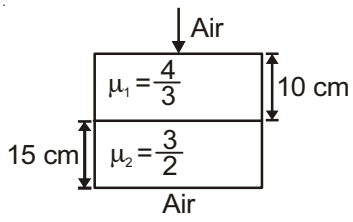
(3) 0.4 (4) 25

16. In a single slit diffraction experiment first minima for λ_1 = 660 nm coincides with first maxima for wavelength λ_2. Calculate λ_2

(1) 770 nm (2) 330 nm

(3) 220 nm (4) 440 nm

17. Find the equivalent refractive index of the combination of two slabs for normal incidence as shown in figure



(1) 1.5 (2) 1.33

(3) 1.43 (4) 1.21

18. A radioactive isotope x has a half-life of 3 s. At t = 0 s, a given sample of this isotope x contains 8000 atoms. The time t when 1000 atoms of isotope x remain in the sample (given $\log_e 2 = 0.693$) is

(1) 9 s (2) 3 s

(3) 8 s (4) 4 s

19. In a common emitter amplifier, the load resistance of the output circuit is 500 times the resistance of the input circuit. If α = 0.98, then find voltage gain

(1) 52400 (2) 24500

(3) 54200 (4) 42500

20. When a proton has a velocity $\vec{v} = (2\hat{i} + 3\hat{j}) \times 10^6$ m/s it experiences a force $\vec{F} = -(1.28 \times 10^{-13}\hat{k})$ N. When its velocity is along the z-axis, it experiences a force along x-axis. What is the magnetic field? (Charge of proton 1.602×10^{-19} C)

(1) $+0.4\hat{j}$ T

(2) $+0.28\hat{i}$ T

(3) $-0.4\hat{j}$ T

(4) $-0.28\hat{i}$ T

21. In a circuit a resistance of 2000 Ω is connected to a capacitor of capacity of 0.1 μF in parallel. A voltage of 20 V and f = 50 Hz is connected across the arrangement. The main current is

(1) 1.18 mA (2) 1.63 mA

(3) 0.63 mA (4) 1.0 mA

22. An insulating rod of length l carries a charge q distributed uniformly on it. The rod is pivoted at an end and is rotated at a frequency f about a fixed perpendicular axis. The magnetic moment of the system is

(1) $\frac{qf\pi l^2}{3}$ (2) $qf\pi l^2$

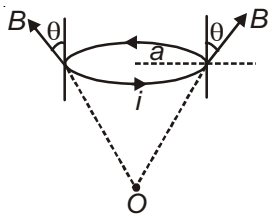
(3) $\frac{qf\pi l^2}{2}$ (4) $\frac{3qf\pi l^2}{4}$

23. A closed circuit consists of a source of emf E and an inductor coil of inductance L, connected in series. The active resistance of whole circuit is R. If inductance of coil abruptly decreased to L/n, then current in the circuit immediately after this is

(1) $\frac{E}{R}$ (2) $\frac{nE}{R}$

(3) $\frac{E}{nR}$ (4) Zero

24. A ring of radius a carries current i is shown in the figure and is kept in a diverging magnetic field, whose magnitude is constant everywhere. Find force on the ring due to the magnetic field



(1) $iB2a$

(2) $iB2\pi a \sin\theta$

(3) $iB\pi a$

(4) $iB2\pi a \cos\theta$

25. The ring of radius a is charged uniformly and having charge q. If the ring is rotating with constant angular velocity ω. Find magnetic moment of the ring

(1) $q\omega a^2$ (2) $\frac{q\omega a^2}{2}$

(3) $\frac{q\omega a^2}{3}$ (4) $\frac{q\omega a^2}{4}$

SECTION - II

Assertion – Reason Type Questions

Directions : *Questions number 26 to 30 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.*

26. **Statement-1:** When current is flowing through a hollow cylinder, then there will be no magnetic field inside the hollow cylinder.

and

Statement-2: When current is flowing through a hollow cylinder, for outside point, magnetic field is same as that of solid cylinder carring same current as hollow cylinder.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

27. **Statement-1:** When unpolarised light is incident at angle i_p on an interface separating air from a medium of refractive index μ, then the reflected light is fully polarised perpendicular to the plane of incidence, provided $\mu = \tan i_p$.

and

Statement-2: Parallel components of incident light disappear and do not refract into the medium with perpendicular components.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

28. **Statement-1:** Rest mass of photon is not zero.

and

Statement-2: Dynamic or kinetic mass of photon is $m = \frac{h}{c\lambda}$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

29. **Statement-1:** When a small quantity of trivalent atom is introduced into pure germanium, the holes are formed. These holes form specific energy level just below the conduction band.

and

Statement-2: When the impurity of antimony is introduced, then each atom of germanium has an extra electron. The energy of these electrons is less than the least energy of conduction band.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

30. **Statement-1:** In case of plane mirror, focal length can be taken as infinite.

and

Statement-2: In case of plane mirror, we get a real image for virtual object and virtual image for a real object.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

[CHEMISTRY]

SECTION - I
Straight Objective Type Questions

This section contains 25 multiple choice questions numbered 31 to 55. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

31. For a given solution, highest melting point is for (1 mole of each is dissolved in one kilogram of water)

(1) CF_3COOH

(2) CCl_3COOH

(3) CH_3COOH

(4) $CH_3–CH_2–COOH$

32. Which among the following is paramagnetic?

(1) $[NiCl_4]^{2-}$ (2) $[Ni(CN)_4]^{2-}$

(3) $[Ni(CO)_4]$ (4) $[Ni(NH_3)_4]$

33. Starting material for the production of $KMnO_4$ is

(1) Chrome iron (2) Wurtzite

(3) Zinc blende (4) Pyrolusite

34. In group-18, boiling point down the group

(1) Remains constant

(2) Increases

(3) First increases then decreases

(4) Decreases

35. Which of the following has highest polarising power?

(1) Li^+ (2) Be^{2+}

(3) B^{3+} (4) Na^+

36. Correct among the following is

(1) In ortho hydrogen nuclear spins are opposite

(2) In para hydrogen electronic spins are same

(3) In ortho hydrogen electronic spins are same

(4) In ortho hydrogen nuclear spins are same

37. Element with highest electron affinity is

(1) O (2) S

(3) N (4) P

38. The reducing acid is

(1) H_3PO_4

(2) H_3PO_3

(3) H_3PO_2

(4) Both (2) & (3)

39. Inversion of sugar is

(1) Change in optical activity

(2) Change in absolute configuration

(3) Change in geometry of sugar

(4) All of these

40. Basic nature of amines in gas phase can be given as

(1) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$

(2) $(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2$

(3) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

(4) All of these

41. $\begin{matrix}CH_2-COOH\\ |\\ CH_2-COOH\end{matrix} \xrightarrow{\text{Kolbe's Electrolysis}} ?$

(1) $H_2C = CH_2$

(2) $HC \equiv CH$

(3) $CH_3 - CH_3$

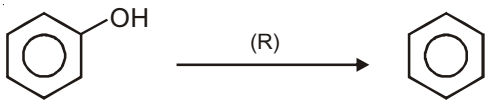
(4) CH_3CH_2COOH

42. $CH_3CHO + HCHO(\text{excess}) \xrightarrow[\text{aq. NaOH}]{\text{conc.}}$.

The number of aldol reaction(s) + cannizzaro reaction(s) that occur in the above reaction is

(1) 1 (2) 2

(3) 3 (4) 4

43. 

Here 'R' is

(1) $LiAlH_4$

(2) $K_2Cr_2O_7$

(3) $NaBH_4$

(4) Zn dust

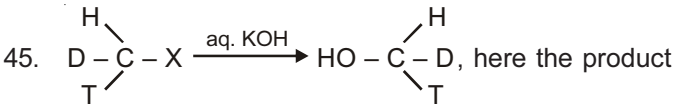
44. Which is the best leaving group in a substitution reaction of an alkyl halide?

(1) Cl^-

(2) Br^-

(3) I^-

(4) F^-

45.  here the product is

(1) Formation is via S_N1

(2) Formation is via S_N2

(3) Reactant and the product are enantiomeric pairs

(4) Both (2) & (3)

46. Which will form alkane?

(1) $RCH = CH_2 \xrightarrow{\text{Wilkinson's catalyst}}$

(2) $RCH = CH_2 \xrightarrow{LiAlH_4}$

(3) $RC \equiv CH \xrightarrow{\text{Lindlar's catalyst}}$

(4) $RC \equiv CH \xrightarrow{Li/NH_3}$

47. $CH_3C \equiv CCH_3 \xrightarrow[H_2O]{KMnO_4/OH^-/\Delta} ?$

(1) $CH_3-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-CH_3$ (2) $CH_3-\overset{\overset{O}{\|}}{C}-OH$

(3) $CH_3-\overset{\overset{O}{\|}}{C}-H$ (4) $CH_3-\overset{\overset{O}{\|}}{C}-CH + CO_2$

48. IUPAC name of  , is

(1) 4-methoxy-2-pentene

(2) 4-methoxy-but-2-ene

(3) 1-methoxy-but-2-ene

(4) 1-methoxy-2-pentene

49. $(\Delta H)_{chemisorption}$ for a gas is 500 kJ mole^{-1} at 500 K and $(\Delta S)_{chemisorption}$ is 1.1 kJ mole^{-1}K^{-1}, then

(1) $(\Delta G)_{chemisorption}$ = –50 kJ mole^{-1}

(2) Chemisorption is endothermic

(3) For chemisorption energy of activation is large

(4) All of these

50. To get one isotope, number of α and β particles to be removed is

(1) 1, 1

(2) 1, 2

(3) 2, 2

(4) 2, 1

51. At a certain concentration, $t_{1/2}$ is 20 minutes. On making concentration double of previous, $t_{1/2}$ becomes $\frac{20}{3}$ minute, order of reaction is, (log2 = 0.3010, log3 = 0.4771)

(1) 1

(2) 1.3

(3) 2.6

(4) 1.9

52. p^o_A = 600 mm of Hg, p^o_B = 500 mm Hg, 2 mole of A and 3 mole of B are mixed, external pressure at which first drop will evaporate is

(1) 760 mm Hg

(2) 640 mm Hg

(3) 600 mm Hg

(4) 540 mm Hg

53. pH at which E_{cell} of hydrogen electrode becomes 0.118 V, is

(1) 2

(2) 5

(3) 9

(4) 12

54. Minimum distance between A^+ and B^- in a rock salt type salt is 270 pm, volume of the unit cell is

(1) $\frac{540}{\sqrt{3}}(pm)^3$ (2) $(540\ pm)^3$

(3) $\left(\frac{540}{\sqrt{2}}pm\right)^3$ (4) $\left(\frac{540}{\sqrt{3}}pm\right)^3$

55. The number of peroxy linkage(s) in K_3CrO_8 is

(1) 2

(2) 4

(3) 6

(4) 1

SECTION - II

Assertion - Reason Type Questions

Directions : *Questions number 56 to 60 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.*

56. **Statement-1:** Salt with lower solubility precipitates first.

and

Statement-2: For precipitation, I.P. > K_{SP}.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

57. **Statement-1:** Equilibrium constant (K) $\propto$ T always.

and

Statement-2: Endothermic reactions are preferred at high temperature.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

58. **Statement-1:** ΔS is state function.

and

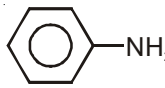
Statement-2: State functions can be integrated for unique answer for given limits irrespective of path.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

59. **Statement-1:** In  , N is sp^3 hybridised.

and

Statement-2: Total electron pairs is the sum of lone pairs and bonded pairs.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

60. **Statement-1:** In 6^{th} orbit to 1^{st} orbit transition of electron in He^+ there are 15 Balmer lines of emission.

and

Statement-2: Number of spectral lines = $\frac{n(n-1)}{2}$.
(where n is the higher energy level)

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

[MATHEMATICS]

SECTION - I

Straight Objective Type Questions

This section contains 25 multiple choice questions numbered 61 to 85. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

61. An infinite G.P. has first term a and sum 4, then a satisfies the interval

(1) $(-\infty, 4)$

(2) $(-\infty, -4)$

(3) $(0, 8)$

(4) $(8, \infty)$

62. The coefficient of x^{11} in the product of $(1 - x)(1 - 4^1x)(1 - 4^2x).....(1 - 4^{11}x)$ is

(1) $\frac{1}{3}(2^{55} - 2^{67})$ (2) $\frac{1}{3}(2^{110} - 2^{134})$

(3) $\frac{1}{3}(2^{134} - 2^{110})$ (4) $\frac{1}{3}(2^{67} - 2^{55})$

63. Different words are formed using the letters of the word INTEGER. Let m_1 be the number of the words in which I and N are never together and m_2 be the number of words which begin with I and end with R, then $\frac{m_1}{m_2}$ is given by

(1) 42

(2) $\frac{1}{7}$

(3) 30

(4) 6

64. Orthogonal trajectories of family of parabolas $y^2 = 4a(x + a)$, where a is an arbitrary constant

(1) $ax^2 = 4cy$

(2) $x^2 + y^2 = a^2$

(3) $y = ce^{-\frac{x}{2a}}$

(4) $axy = c^2$

65. Let $f(x)$ be a function satisfying the condition $f'(x) = \sqrt{1-(f(x))^2}$ with $f(0) = 0$, then the value of the integral $\int e^x \cdot f^{-1}(x)dx + \int \frac{e^x}{\sqrt{1-x^2}}dx$ is

(1) $e^x \cos x + c$

(2) $e^x \sin x + e^x \sin^{-1}x + c$

(3) $e^x \sin^{-1}x + c$

(4) $e^x \cos^{-1}x + e^x \sin^{-1}x + c$

66. $\lim\limits_{x\to\frac{\pi}{4}} \frac{4\sqrt{2}-(\sin x+\cos x)^5}{1-\sin 2x} =$

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

(3) $4\sqrt{2}$ (4) $5\sqrt{2}$

67. The function $f(x) = \begin{cases} \frac{1}{x}\sin(x^2) & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$ is

(1) Continuous and differentiable at $x = 0$

(2) Continuous but not differentiable at $x = 0$

(3) Continuous at $x = 1$ and differentiable at $x = 2$

(4) Neither continuous nor differentiable at $x = 0$

68. If $(\alpha + \beta)$ and $(\alpha - \beta)$ are eccentric angles of the point P and Q respectively on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, then the equation of chord PQ is

(1) $\frac{x}{a}\cos\alpha+\frac{y}{b}\sin\alpha=0$

(2) $\frac{x}{a}\cos\alpha+\frac{y}{b}\sin\alpha=\cos\beta$

(3) $\frac{x}{a}\sin\alpha+\frac{y}{b}\cos\alpha=0$

(4) $\frac{x}{a}\sin\alpha+\frac{y}{b}\cos\alpha=\cos\beta$

69. The equation of tangent at $x = 1$, if y is given by $y = \int_{x^2}^{x^3} \frac{dt}{\sqrt{1+t^2}}$

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

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

(3) $y = x\sqrt{2}+1$

(4) $y = 1-x\sqrt{2}$

70. A speaks the truth 75% of cases and B in 80% of cases. The percentage of cases they are likely to contradict each other in stating the same fact is

(1) 30%

(2) 35%

(3) 40%

(4) 25%

71. The locus of the mid-points of all the lines joining each point on $(x - h)^2 + (y - k)^2 = r^2$ with origin is

(1) $(2x - h)^2 + (2y - k)^2 = r^2$

(2) $(x + h)^2 + (y + k)^2 = 4r^2$

(3) $(2x - h)^2 + (2y - k)^2 = 4r^2$

(4) $(2x + h)^2 + (2y + k) = r^2$

72. The equation of lines joining (0, 0) and points of intersection of $x^2 + y^2 + 2xy = 4$, $3x^2 + 5y^2 - xy = 7$ is

(1) $x^2 + y^2 - xy = 0$

(2) $5x^2 + 2y^2 - 13xy = 0$

(3) $5x^2 + y^2 - 6xy = 0$

(4) $5x^2 + 13y^2 - 18xy = 0$

73. The function given by $y = 2[x] + \cos x$ for $f : R \to R$ is

(1) Many one, onto

(2) One-one, into

(3) Many one, into

(4) One-one, onto

74. The values of x for which $2x^4 \le \cos^6 x + \sin^4 x - 1$ is/are

(1) $\left(0, \frac{\pi}{4}\right)$

(2) $(-1, 1)$

(3) $\{0\}$

(4) $(0, 1)$

75. Area of region bounded by curves $y = 2^x$ and $y = 2x - x^2$ between the ordinates $x = 0$ and $x = 2$ is

(1) $\frac{2}{\log 2} - \frac{4}{3}$

(2) $\frac{3}{\log 2} - \frac{4}{3}$

(3) $\frac{1}{\log 2} - \frac{4}{3}$

(4) $\frac{4}{\log 2} - \frac{3}{2}$

76. The shortest distance between the straight lines $\frac{x-6}{1} = \frac{2-y}{2} = \frac{z-2}{2}$ and $\frac{x+4}{3} = \frac{y}{-2} = \frac{1-z}{2}$ is

(1) 9

(2) $\frac{25}{3}$

(3) $\frac{16}{3}$

(4) 4

77. In ΔABC, if $\angle A = 60°$, $a = 5$, $b = 4$, then c is the root of equation (where a, b, c are sides of triangle ABC)

(1) $c^2 - 9c - 9 = 0$

(2) $c^2 - 4c - 9 = 0$

(3) $c^2 - 10c + 25 = 0$

(4) $c^2 - 5c - 41 = 0$

78. If α and β are real roots of equation $x^2 - k^2x + k^2 + 1 = 0$ and if $p = \frac{1}{\alpha} + \frac{1}{\beta}$, then range of p is

(1) $[0, \infty)$

(2) $[0, 1)$

(3) $(-\infty, 0]$

(4) R

79. If $\hat{i} - \hat{k}, \lambda\hat{i} + \hat{j} + (1-\lambda)\hat{k}$ and $\mu\hat{i} + \lambda\hat{j} + (1+\lambda-\mu)\hat{k}$ are three coterminus edges of a parallelopiped, then its volume depends on

(1) Only λ

(2) Only μ

(3) Both λ and μ

(4) Neither λ nor μ

80. The remainder when 5^{97} is divided by 52 is

(1) 2

(2) 3

(3) 5

(4) 10

81. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 1 \end{bmatrix}$ and a matrix C is defined as $C = (BAB^{-1})(B^{-1}A^TB)$, where $|B| \neq 0$ and $|C| = k^2$, the k =

(1) 1 (2) 2

(3) 4 (4) 16

82. $\int_0^{\pi/4} [\tan^n(x - [x]) + \tan^{n-2}(x - [x])]dx =$ (where $[x]$ = greatest integer function)

(1) $\frac{1}{n-1}$

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

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

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

83. Number of solutions of the equation $\tan^2 x - \sec^{10} x + 1 = 0$ in (0, 10) is

(1) 3

(2) 6

(3) 10

(4) 0

84. Let $A = \begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} a \\ b \\ 1 \end{bmatrix}$. If AB is a scalar multiple of B, then $a + b$ =

(1) 1

(2) 2

(3) –1

(4) –2

85. If a variable X takes values 0, 1, 2, ..., n with frequencies proportional to the binomial coefficients ${}^nC_0$, ${}^nC_1$, ${}^nC_2$, ..., ${}^nC_n$, the variance (X) is

(1) $\sqrt{\frac{n^2-1}{12}}$

(2) $\sqrt{\frac{n}{2}}$

(3) $\sqrt{\frac{n}{4}}$

(4) $\sqrt{n}$

SECTION - II

Assertion – Reason Type Questions

Directions : *Questions number 86 to 90 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.*

86. **Statement-1:** If $k|z - b| = |kz - a|$, then locus of z is a straight line parallel to imaginary axis. (ka, $b \in R$)

and

Statement-2: $\text{Re}(z) = \left(\frac{kb + a}{k}\right)$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

87. **Statement-1:** $f(x) = |x^2 - 4|$ and $f(-2) = f(2)$ and there exists at least one c in such that $f'(c) = 0$.

and

Statement-2: If $f(x)$ is continuous in $[a, b]$ and differentiable in (a, b) and $f(a) = f(b)$, then according to Rolle's theorem, there exists at least one c in (a, b) such that $f'(c) = 0$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

88. **Statement-1:**

$$\int_{1/2}^{\pi} (\sec^2 x \times \log x)\,dx = \int_{1/2}^{\pi/2} (\sec^2 x \log x)\,dx + \int_{\pi/2}^{\pi} (\sec^2 x \log x)\,dx$$

and

Statement-2: $\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$ if and only if $a < c < b$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

89. **Statement-1:** Hyperbola $6x^2 - 6y^2 + 5xy + 11x - 29y - 39 = 0$ is rectangular in nature.

and

Statement-2: Hyperbola is rectangular if the asymptotes are perpendicular to each other.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

90. **Statement-1:** If p, q, r are simple propositions with truth values T, F, T then the truth value of $(\sim p \vee q) \wedge \sim r \Rightarrow p$ is true.

and

Statement-2: $\sim(p \vee q) \wedge \sim r \Rightarrow p$ is a tautology.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

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MOCK TEST PAPER

for

JEE(Main)-2016

ANSWERS

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

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MOCK TEST PAPER

for

JEE(Main)-2016

[HINTS & SOLUTIONS]

[PHYSICS]

1. Answer (3)

$$v_x = v_0\left(1-\frac{\cos v_0 t}{r}\right)$$

$$v_y = v_0 \sin\frac{v_0 t}{r}$$

$$v = \sqrt{v_x^2 + v_y^2} = 2v_0 \sin\frac{v_0 t}{2r}$$

2. Answer (1)

$$x = 980\left[\frac{\text{cm}}{\text{km}}\right]\left[\frac{\text{s}}{\text{h}}\right]^{-2}$$

$$= 980\times\left[\frac{1}{10^5}\right]\left[\frac{1}{3600}\right]^{-2}$$

$$= 980\times\frac{1}{10}\times 36\times 36$$

3. Answer (2)

Voltage across $r_1 = 2\left(\frac{2}{2+10^5}\right) \simeq 4\times10^{-5}$ V

$$I = \frac{4\times10^{-5}}{900+100} = 4\times10^{-8}\ \text{A}$$

$$S = \frac{20}{4\times10^{-8}} = 5\times10^8$$

4. Answer (3)

$$V_A - V_B = 30\hat{i} + 30\hat{j}$$

$$V_B = -20\hat{j}$$

$$V_C - V_A = -10\hat{i} + 10\hat{j}$$

$$\Rightarrow \vec{V_C} = 20\hat{i} + 20\hat{j}$$

5. Answer (4)

$m \times 540 + m \times (100 - 90)$

$= 100 \times 1 \times (90 - 24)$

$\Rightarrow m = 12$ g

6. Answer (3)

$$\sqrt{I_2^2 - \frac{I_1^2}{4}} = \sqrt{[I_2(1+\alpha_2\theta)]^2 - \frac{I_1^2}{4}(1+\alpha_1\theta)^2}$$

$$\Rightarrow I_2^2 - \frac{I_1^2}{4} = I_2^2(1+2\alpha_2\theta) - \frac{I_1^2}{4}(1+2\alpha_1\theta)$$

$$\Rightarrow \frac{I_1}{I_2} = 2\sqrt{\frac{\alpha_2}{\alpha_1}}$$

7. Answer (1)

$$\frac{3}{2}nRT = \frac{3}{2}PV$$

$$7.5\times10^3\ \text{J} = \frac{3}{2}P(10\times10^{-3}\ \text{m}^3)$$

$\Rightarrow P = 5 \times 10^5$

8. Answer (4)

$$C_0 = \sqrt{\frac{\gamma P_0}{\rho_0}} = \sqrt{\frac{1.36 \times (1.013 \times 10^5)}{0.001293}}$$

= 32640 cm/s

Velocity at 17°C

$$\frac{C_1}{32640} = \sqrt{\frac{290}{273}}$$

$\Rightarrow$ C_1 = 33640 cm/s

$$\nu = \frac{33640}{66.5} = 506 \text{ Hz}$$

9. Answer (4)

$$B_2 - B_1 = 10\left[\log_{10}\left(\frac{I_2}{I_0}\right) - \log_{10}\left(\frac{I_1}{I_0}\right)\right]$$

$$30 = 10\log_{10}\left(\frac{I_2}{I_1}\right)$$

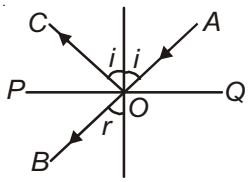
$$\Rightarrow \quad \frac{I_2}{I_1} = 10^3$$

$$\frac{P_2}{P_1} = \sqrt{1000} = 32$$

10. Answer (1)

$90 - i + 90 + r = 150°$

$i - r = 30°$



$i + r = 120°$

$$\mu = \frac{\sin 75°}{\sin 45°} = 1.37$$

11. Answer (1)

As temperature is constant

PV = constant

$PdV + VdP = 0$

$$-\frac{(dV/dP)}{V} = \frac{1}{P}$$

12. Answer (2)

$$U = \frac{Q\lambda}{4\pi\varepsilon_0}\int_0^2 \frac{dx}{4-x} = 9\ln 2 \text{ J}$$

13. Answer (3)

Total energy stored on capacitor appears as heat in resistor.

$$\Delta H = \frac{q_0^2}{2C} = \frac{(30\times10^{-6})^2}{2\times3\times10^{-6}} = 0.15 \text{ mJ}$$

14. Answer (4)

$$\frac{1}{27.5} = \frac{1}{20} + \frac{1}{f_2}$$

$$\Rightarrow \quad f_2 = -\frac{220}{3} \text{ cm}$$

$$\frac{1}{f_2} = \frac{1}{f_{\text{glass lens}}} + \frac{1}{f_{\text{water lens}}}$$

$$\Rightarrow \quad R = \frac{220}{9}$$

15. Answer (3)

$$m = \frac{20}{50} = 0.4$$

16. Answer (4)

$d\sin\theta_1 = \lambda_1$ 1st minima

$$d\sin\theta_2 = \frac{3\lambda_2}{2} \quad \text{1st maxima}$$

$$\lambda_1 = \frac{3\lambda_2}{2}$$

17. Answer (3)

$$\frac{t_1 + t_2}{\mu} = \frac{t_1}{\mu_1} + \frac{t_2}{\mu_2}$$

18. Answer (1)

$$\lambda = \frac{\log_e 2}{T_{1/2}} = \frac{0.693}{3} = 0.231 \text{ s}^{-1}$$

$$t_1 = \frac{1}{\lambda}\log_e\frac{N_0}{N} = \frac{1}{0.231}\log_e 8 = \frac{3\times0.693}{0.231} = 9$$

19. Answer (2)

$$\beta = \frac{\alpha}{1-\alpha} = \frac{0.98}{1-0.98} = 49$$

$$\frac{R_{out}}{R_{in}} = 500$$

$$\text{Voltage gain} = \beta\left(\frac{R_{out}}{R_{in}}\right)$$

$$= (49)(500) = 24500$$

20. Answer (3)

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$B_0 = 0.4$

21. Answer (1)

$$I_C = \frac{20}{\left(\frac{1}{2\times 3.14\times 50\times 0.1\times 10^{-6}}\right)} = 0.63 \text{ mA}$$

$$I_R = \frac{20}{20000} = 1.0 \text{ mA}$$

$$I^2 = I_C^2 + I_R^2$$

$\Rightarrow$ I = 1.18 mA

22. Answer (1)

$$\int dM = IA = \int_0^L \frac{q}{l} f\pi x^2\, dx = \frac{qf\pi l^2}{3}$$

23. Answer (2)

$\phi = LI$ = constant

$$L_1 I_1 = \frac{L_1}{n} \cdot I_2$$

24. Answer (2)

Due to vertical component $B\cos\theta$, there will be no force on the ring while due to horizontal component $B\sin\theta$, the net force will be in vertically downward direction.

25. Answer (2)

$$i = \frac{q}{\tau} = \frac{q\omega}{2\pi}$$

$$\mu = \frac{q\omega}{2\pi}\pi a^2 = \frac{q\omega a^2}{2}$$

26. Answer (2)

27. Answer (3)

28. Answer (4)

29. Answer (4)

30. Answer (2)

[CHEMISTRY]

31. Answer (4)

32. Answer (1)

Cl^- being weaker ligand does not pair so electrons remain unpaired.

33. Answer (4)

$$MnO_2 + KOH + O_2 \rightarrow K_2MnO_4 \xrightarrow{Cl_2} KMnO_4 + KCl$$

34. Answer (2)

As boiling point $\propto$ surface area and surface area increases down the group.

35. Answer (3)

$$\text{Polarising power} \propto \frac{q}{r}$$

36. Answer (4)

When nuclear spins are same it is ortho hydrogen.

37. Answer (2)

Electron affinity of 3rd period elements is maximum.

38. Answer (4)

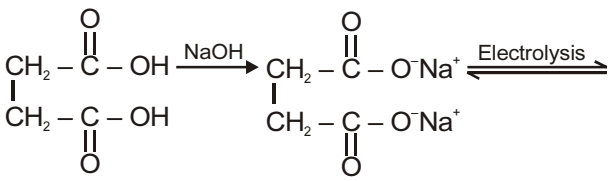
39. Answer (1)

Nature of optical activity of pure sugar becomes opposite when dissolved in water, this is inversion of sugar.

40. Answer (3)

(1) & (2) are true in aqueous medium.

41. Answer (1)



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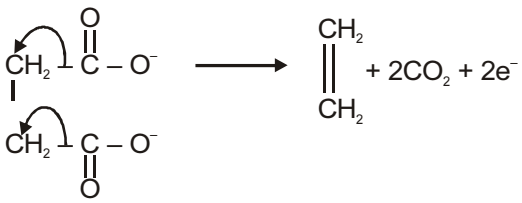
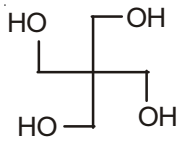


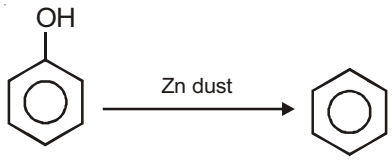
42. Answer (4)

Three aldol condensation reactions and then, one Cannizzaro reaction when no-α(Hydrogen) is left.

Final product formed is



43. Answer (4)



44. Answer (3)

Concept based.

45. Answer (2)

As $\overset{\oplus}{C}H_3$ is an unstable carbocation so S_N2 is the major mechanism ($\approx$ 100%).

46. Answer (1)

Only Wilkinson's catalyst will form RCH_2CH_3.

47. Answer (2)

$KMnO_4/OH^-/D$ causes oxidative cleavage of ($\equiv$) bond.

48. Answer (3)

As per IUPAC.

49. Answer (4)

$(\Delta G) = \Delta H - T\Delta S$

$= 500 - 500 \times 1.1 = -50$ kJ mole^{-1}

$\because$ Reaction takes place at high temperature so 'E_a' will be higher.

50. Answer (2)

$$\underset{(I)}{{}^{m}_{z}A} \xrightarrow{-1\alpha} {}^{m-4}_{z-2}B \xrightarrow{-2\beta} \underset{(II)}{{}^{m-4}_{z}A}$$

(I) and (II) are isotopes

51. Answer (3)

$$\frac{(t_{1/2})_1}{(t_{1/2})_2} = \frac{[A_0]_1^{1-n}}{[A_0]_2^{1-n}} \Rightarrow \frac{20}{\left(\frac{20}{3}\right)} = \frac{(A_0)^{1-n}}{(2)^{1-n}(A_0)^{1-n}}$$

$\therefore \quad 3 = (2)^{n-1} \Rightarrow \log 3 = (n-1)\log 2$

$$n = \frac{0.4771}{0.3010} + 1 = 2.6$$

52. Answer (4)

First drop will evaporate when vapour pressure of solution is same as external pressure.

$$P_{solution} = \frac{2}{5} \times 600 + \frac{3}{5} \times 500 = 240 + 300 = 540 \text{ mm Hg}$$

53. Answer (1)

$$0.118 = 0 - \frac{0.0591}{1}\log[H^+]$$

$$\left(\frac{1}{2}H_{2(g)} \longrightarrow H^+ + 1e^-\right)$$

$= + 0.0591 (-\log[H^+])$

$\therefore \quad \log[H^+] = -2$

$\therefore \quad pH = 2$

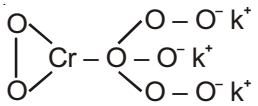
54. Answer (2)

Edge length = 2 (minimum distance)

$= 2 \times 270$ pm

Volume of unit cell = $a^3 = (540 \text{ pm})^3$

55. Answer (2)



Peroxy linkages = 4

56. Answer (1)

With lower solubilities K_{SP} will be low so ionic product (I.P.) exceeds easily.

57. Answer (4)

For endothermic reaction, equilibrium constant (K) $\propto T$

While for exothermic reaction, equilibrium constant $(K) \propto \frac{1}{T}$.

58. Answer (2)

ΔS only depends upon initial and final conditions of system, so path independent.

59. Answer (4)

Due to delocalisation of lone pair of electron of N effective electron pairs on N = 3

$\Rightarrow$ sp^2

60. Answer (4)

Total emission lines = $\frac{5 \times 6}{2} = 15$ and not the Balmer lines.

[MATHEMATICS]

61. Answer (3)

$$\frac{a}{1-r}=4$$

$$\Rightarrow \quad 1-r=\frac{a}{4}$$

$$\Rightarrow \quad r=1-\frac{a}{4}$$

$$\Rightarrow \quad -1<1-\frac{a}{4}<1$$

$$\Rightarrow \quad -2<\frac{-a}{4}<0$$

$$\Rightarrow \quad 0<\frac{a}{4}<2$$

$$\Rightarrow \quad 0 < a < 8$$

62. Answer (2)

Coefficient x^{11} =

$$-\left(1+\frac{1}{4}+\frac{1}{4^2}+.....+\frac{1}{4^{11}}\right)4^{1+2+.....+11}$$

$$= -\left[\frac{1-\left(\frac{1}{4}\right)^{12}}{1-\frac{1}{4}}\right]4^{66}$$

$$= -\frac{1}{3}(4^{12}-1)\cdot 4^{55}$$

$$= \frac{1}{3}(2^{110}-2^{134})$$

63. Answer (3)

$$m_1=\frac{7!}{2!}-\frac{6!}{2!}\times 2!$$

$$m_2=\frac{5!}{2!}$$

$$\frac{m_1}{m_2}=30$$

64. Answer (3)

$$2y\frac{dy}{dx}=4a$$

$$\frac{dy}{dx}=\frac{2a}{y}$$

For orthogonal trajectory,

$$\frac{dy}{dx}=\frac{-y}{2a}$$

$$\Rightarrow \quad \int\frac{dy}{y}=-\int\frac{dx}{2a}+c$$

$$\Rightarrow \quad \ln y=-\frac{x}{2a}+c$$

$$\Rightarrow \quad y = c\cdot e^{-x/2a}$$

65. Answer (3)

$\sin^{-1}f(x) = x + c$

$\sin^{-1}(0) = 0 + c$

$c = 0$

$\sin^{-1}f(x) = x$

$f^{-1}(x) = y = \sin^{-1}x$

$$= \int e^x\left(\sin^{-1}x+\frac{1}{\sqrt{1-x^2}}\right)dx$$

$= e^x \sin^{-1}x + c$

66. Answer (4)

Putting $x=\left(\frac{\pi}{4}+h\right)$

L =

$$\lim_{h\to 0}\frac{4\sqrt{2}-\left[\left(\frac{\cos h}{\sqrt{2}}+\frac{\sin h}{\sqrt{2}}\right)+\left(\frac{\cos h}{\sqrt{2}}-\frac{\sin h}{\sqrt{2}}\right)\right]^5}{1-\cos 2h}$$

$$= \lim_{h\to 0}\frac{4\sqrt{2}-(\sqrt{2}\cos h)^5}{2\sin^2 h}$$

$$= \lim_{h\to 0}\frac{4\sqrt{2}(1-\cos^5 h)}{2\sin^2 h}$$

$$= \lim_{h\to 0}\frac{4\sqrt{2}(1-\cos h)(1+\cos h+\cos^2 h+\cos^3 h+\cos^4 h)}{2\sin^2 h}$$

$$= \lim_{h\to 0}\frac{4\sqrt{2}\left(2\sin^2\frac{h}{2}\right)\times 5}{2\sin^2 h} = 5\sqrt{2}$$

67. Answer (1)

$$\lim_{x\to 0} f(x) = \lim_{x\to 0} \frac{1\cdot x}{x\cdot x}\cdot \sin(x^2) = 0$$

$\Rightarrow$ Continuous at $x = 0$

$$f'(x) = \frac{1}{x}\cos(x^2)\cdot 2x - \frac{1}{x^2}\cdot \sin(x^2)$$

$$\lim_{x\to 0} f'(x) = 2 - 1 = 1$$

68. Answer (2)

Equation of chord with points joining eccentric angles A and B is given by

$$\frac{x}{a}\cos\left(\frac{A+B}{2}\right) + \frac{y}{b}\sin\left(\frac{A+B}{2}\right) = \cos\left(\frac{A-B}{2}\right)$$

$\therefore$ Here chord

$$\Rightarrow \quad \frac{x}{a}\cos\left(\frac{\alpha+\beta+\alpha-\beta}{2}\right) + \frac{y}{b}\sin\left(\frac{\alpha+\beta+\alpha-\beta}{2}\right)$$

$$= \cos\left(\frac{\alpha+\beta-\alpha+\beta}{2}\right)$$

$$\Rightarrow \quad \frac{x}{a}\cos\alpha + \frac{y}{b}\sin\alpha = \cos\beta$$

69. Answer (2)

Using Newton-Leibniz rule,

$$\frac{dy}{dx} = \frac{3x^2}{\sqrt{1+x^2}} - \frac{2x}{\sqrt{1+x^2}}$$

$$\left.\frac{dy}{dx}\right|_{x=1} = \frac{3-2}{\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$y \text{ at } x = 1 = \int_1^1 \frac{dt}{\sqrt{1+t^2}} = 0$$

$\Rightarrow$ Equation of tangent,

$$y = \frac{1}{\sqrt{2}}(x-1)$$

$$y\sqrt{2} + 1 = x$$

70. Answer (2)

$$P(A \text{ speaking truth}) = \frac{75}{100} = \frac{3}{4}$$

$$P(B \text{ speaking truth}) = \frac{80}{100} = \frac{4}{5}$$

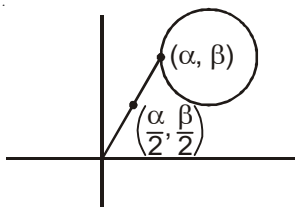
$\therefore$ Required probability $= P(A)\cdot P(\bar{B}) + P(B)\cdot P(\bar{A})$

$$= \frac{3}{4}\times\frac{1}{5} + \frac{1}{4}\times\frac{4}{5}$$

$$= \frac{7}{20} = 35\%$$

71. Answer (1)

$$x = \frac{\alpha}{2} \quad \Rightarrow \quad \alpha = 2x$$

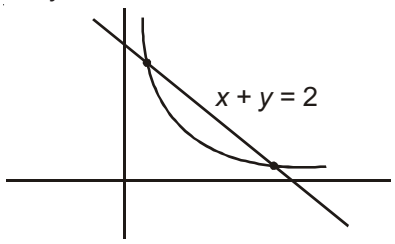


$$y = \frac{\beta}{2} \quad \Rightarrow \quad \beta = 2y$$

$(2x - h)^2 + (2y - k)^2 = r^2$

72. Answer (4)

$x + y = \pm 2$



$$\Rightarrow \quad 3x^2 + 5y^2 - xy = 7\left(\frac{x+y}{2}\right)^2$$

$\Rightarrow$ $4(3x^2 + 5y^2 - xy) = 7(x^2 + y^2 + 2xy)$

$$\Rightarrow \quad \boxed{5x^2 + 13y^2 - 18xy = 0}$$

73. Answer (3)

$y = 2[x] + \cos x$ is many-one, into

$$y = \begin{cases} -2 + \cos x, & -1 \le x < 0 \\ 0 + \cos x, & 0 \le x < 1 \\ 2 + \cos x, & 1 \le x < 2 \end{cases}$$

Range of the function is having discrete values (into function)

$f'(x) = -\cos x$

Function is increasing as well decreasing so many-one.

74. Answer (3)

$2\cdot x^4 \le \cos^6 x - (1 - \sin^2 x)(1 + \sin^2 x)$

$\le \cos^6 x - \cos^2 x(1 + \sin^2 x)$

$\le \cos^2 x[\cos^4 x - 1 - \sin^2 x]$

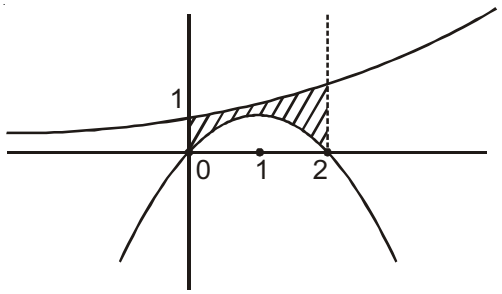
$\le \cos^2 x[-\sin^2 x(1 + \cos^2 x) - \sin^2 x]$

$\le -\cos^2 x \sin^2 x[+2 + \cos^2 x]$

True only for $x = 0$

75. Answer (2)

$$A = \int_0^2 [2^x - (2x - x^2)]\, dx$$



$$= \left[\frac{2^x}{\log 2} - x^2 + \frac{x^3}{3}\right]_0^2$$

$$= \frac{(4-1)}{\log 2} - 4 + \frac{8}{3}$$

$$= \frac{3}{\log 2} - \frac{4}{3}$$

76. Answer (2)

$x_1 = 6,\ y_1 = 2,\ z_1 = 2,\ a_1 = 1,\ b_1 = -2,\ c_1 = 2$

$x_2 = -4,\ y_2 = 0,\ z_2 = 1,\ a_2 = 3,\ b_2 = -2,\ c_2 = -2$

$$\therefore \text{ S.D. } = \frac{\begin{vmatrix} x_1 - x_2 & y_1 - y_2 & z_1 - z_2 \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}}{\left\| \begin{matrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{matrix} \right\|}$$

$$= \frac{\begin{vmatrix} 10 & 2 & 1 \\ 1 & -2 & 2 \\ 3 & -2 & -2 \end{vmatrix}}{\left\| \begin{matrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -2 & 2 \\ 3 & -2 & -2 \end{matrix} \right\|}$$

$$= \frac{100}{|8\hat{i} + 8\hat{j} + 4\hat{k}|} = \frac{100}{12} = \frac{25}{3}$$

77. Answer (2)

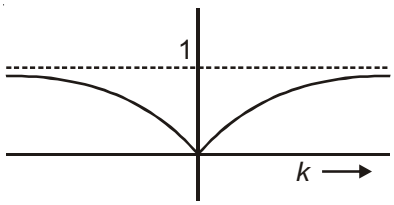
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\frac{1}{2} = \frac{16 + c^2 - 25}{2 \times 4 \times c}$$

$c^2 - 4c - 9 = 0$

78. Answer (2)

$$p = \frac{1}{\alpha} + \frac{1}{\beta}$$



$$= \frac{\alpha + \beta}{\alpha\beta}$$

$$= \frac{k^2}{k^2 + 1}$$

$\therefore$ Range = [0, 1)

79. Answer (4)

Volume = $[\vec{a}\ \ \vec{b}\ \ \vec{c}]$

$$= \begin{vmatrix} 1 & 0 & -1 \\ \lambda & 1 & 1-\lambda \\ \mu & \lambda & 1+\lambda-\mu \end{vmatrix}$$

$$= \begin{vmatrix} 0 & 0 & -1 \\ 1 & 1 & 1-\lambda \\ 1+\lambda & \lambda & 1-\lambda-\mu \end{vmatrix} \qquad C_1 \to C_1 + C_3$$

$= -1(\lambda - 1 - \lambda)$

$= 1$

80. Answer (3)

$5^{97} = (5^4)^{24} \times 5$

$= (625)^{24} \times 5$

$= (52 \times 12 + 1)^{24} \times 5$

$= (52I + 1)5$

$\therefore$ Remainder = 5

81. Answer (3)

$|C| = |B| \cdot |A|\, |B^{-1}|\, |B^{-1}|\, |A^T|\, |B|$

$|C| = |A|\, |A^T|\, |B|\, |B^{-1}|\, |B|\, |B^{-1}|$

$\Rightarrow |C| = |A \cdot A^T| \cdot |B \cdot B^{-1}| \cdot |B \cdot B^{-1}|$

$|C| = |A| \cdot |A^T|$

$|C| = |A| \cdot |A^T| = |A|^2$

$\Rightarrow K = |A| = 4$

82. Answer (1)

For $x \in \left(0, \frac{\pi}{4}\right)$ $[x] = 0$

$\Rightarrow I = \int_0^{\pi/4} (\tan^n x + \tan^{n-2} x)\,dx$

$= \int_0^{\pi/4} \tan^{n-2} x(\sec^2 x)\,dx$

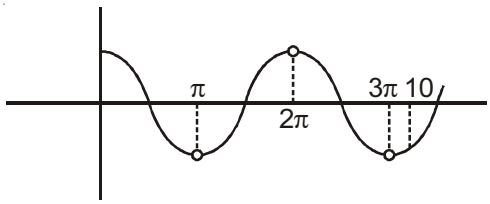
$\tan x = t$

$\sec^2 x\,dx = dt$

$\int_0^1 t^{n-2}\,dt = \frac{t^{n-1}}{n-1}\Big|_0^1 = \frac{1}{n-1}$

83. Answer (1)

$\tan^2 x - \sec^{10} x + 1 = 0$



$\Rightarrow \sec^2 x - \sec^{10} x = 0$

$\Rightarrow \sec^2 x(1 - \sec^8 x) = 0$

$\sec x \neq 0$

$\Rightarrow \sec^8 x = 1$

$\sec x = \pm 1$

$\Rightarrow \cos x = \pm 1$

$\Rightarrow$ Number of solution = 3

84. Answer (4)

$AB = \lambda B$

$(A - \lambda)B = 0$

$$\begin{bmatrix} -3-\lambda & -7 & -5 \\ 2 & 4-\lambda & 3 \\ 1 & 2 & 2-\lambda \end{bmatrix} \begin{bmatrix} a \\ b \\ 1 \end{bmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} -3-\lambda & -7 & -5 \\ 2 & 4-\lambda & 3 \\ 1 & 2 & 2-\lambda \end{vmatrix} = 0$$

$\Rightarrow (\lambda - 1)^3 = 0$

$\Rightarrow \lambda = 1$

$\therefore$ $4a + 7b + 5 = 0$ and $2a + 3b + 3 = 0$

$\Rightarrow a = -3,\ b = 1$

$\therefore$ $a + b = -2$

85. Answer (3)

Variance $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{n} f_i (x_i - \bar{X})^2}$

$= \sqrt{\frac{{}^nC_0\left(0 - \frac{n}{2}\right)^2 + {}^nC_1\left(1 - \frac{n}{2}\right)^2 + \ldots\ldots + {}^nC_n\left(n - \frac{n}{2}\right)^2}{2^n}}$

$= \sqrt{\frac{n}{4}} = \frac{\sqrt{n}}{2}$

86. Answer (3)

$k|z - b| = |kz - a|$

Let $z = (x + iy)$

$\Rightarrow k^2[(x - b)^2 + y^2] = (kx - a)^2 + k^2y^2$

$\Rightarrow (2k^2b - 2ka)x = k^2b^2 - a^2$

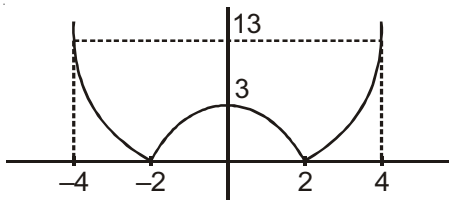
$$x = \frac{(kb + a)(kb - a)}{2k(kb - a)}$$

$$x = \frac{kb + a}{2k}$$

$$\Rightarrow \text{Re}(z) = \frac{kb + a}{2k}$$

$\Rightarrow$ Statement-1 is true and Statement-2 is false.

87. Answer (2)



Statement-2 is true and Statement-1 is true. But explanation is not true.

Therefore, option (2) is correct.

88. Answer (3)

Statement-1 is true and Statement-2 is false.

89. Answer (1)

H : $6x^2 - 6y^2 + 5xy + 11x - 29y - 39 = 0$

$\Rightarrow (2x + 3y + 7)(3x - 2y - 5) = 4$

$\Rightarrow$ Asymptotes $\Rightarrow$ $(2x + 3y + 7) = 0$ and $(3x - 2y - 5) = 0$ (Perpendicular)

$\therefore$ Option (1) is correct.

90. Answer (2)

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