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Time: 3 Hour Total Marks: 300

JEE (Mains)

Subject : Chemistry

MCQ SINGLE CORRECT

1. What is the mass percent of carbon in carbon dioxide?

(a) 0.034% **(b)** 27.27%

(c) 3.4% **(d)** 28.7%

2. Which of the following elements does not show disproportionation tendency?

(a) Cl **(b)** Br

(c) F **(d)** I

3. Oxidation number of P in PO_4^{3-}, of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$ are respectively

(a) - 3, +6 and +6 **(b)** +5, +6 and +6

(c) +3, +6 and +5 **(d)** +5, +3 and +6

4. Which of the following is most acidic?

(a) Benzyl alcohol **(b)** Cyclohexanol

(c) Phenol **(d)** m-chlorophenol

5. Which of the following is an insecticide?

(a) bakelite **(b)** aspirin

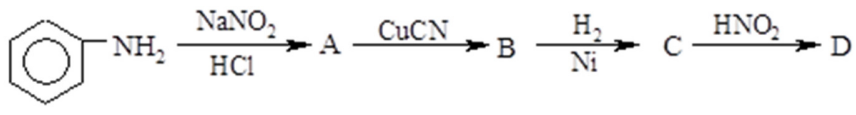
(c) DDT **(d)** TNT

6. The monomeric unit of teflon consists of

(a) Isoprene **(b)** 2-chloro-1, 3-butadiene (chloroprene)

(c) Butadiene **(d)** Tetrafluorethylene

7. Aniline in a set of reactions yielded a product D.



The structure of the product D would be

(a) $C_6H_5NHCH_2CH_3$ **(b)** $C_6H_5CH_2NH_2$

(c) $C_6H_5CH_2OH$ **(d)** C_6H_5NHOH

All The Best!!!

8. When ammonia is added to green aqueous solution of nickel (II) sulphate, the colour of the solution changes to the violet. This is caused by

(a) nickel ion undergoing a change in oxidation state

(b) ammonia molecules replacing water molecules surrounding nickel

(c) change in co-ordination number of nickel

(d) change is pH value of the solution

9. In order to refine 'blister copper' it is melted in a furnace and is stirred with green logs of wood. The purpose is

(a) To expel the dissolved gases in blister copper

(b) To reduce the metallic oxide impurities with hydrocarbon gases liberated from the wood

(c) To bring the impurities to surface and oxidise them

(d) To increase the carbon content in copper

10. Gold number is minimum in case of

(a) Gelatin

(b) Egg albumin

(c) Gum Arabic

(d) Starch

11. The freezing point depression constant for water is 1·86°C m^{-1}. If 5·00 g Na_2SO_4 is dissolved in 45·0 g H_2O, the freezing point is changes by 3·82°C. Calculate the van't Hoff factor for Na_2SO_4. (Mol. Mass of Na_2SO_4) = 142 g mol^{-1})

(a) 0·381

(b) 3·11

(c) 2·05

(d) 2·63

12. The degree of dissociation (α) of a weak electrolyte A_xB_y is related to Van't Hoff factor (i) by the expression

(a) $\alpha = \frac{(i-1)}{(x+y-1)}$

(b) $\alpha = \frac{(i-1)}{(x+y+1)}$

(c) $\alpha = \frac{(x+y-1)}{(i-1)}$

(d) $\alpha = \frac{(x+y+1)}{(i-1)}$

13. A 0.01 M ammonia solution is 5% ionized. The concentration of the OH^- ions is

(a) 0.005 M

(b) 0.0001 M

(c) 0.0005 M

(d) 0.05

14. Sulphuryl chloride, SO_2Cl_2 reacts with H_2O to give mixture of H_2SO_4 and HCl. Aqueous solution of 1 mol SO_2Cl_2 will be neutralized by

(a) 3 moles of NaOH

(b) 2 moles of $Ca(OH_2)$

(c) Both (A) and (B)

(d) None of these

15. Organic solids can be purified by

(a) Steam distillation **(b)** Crystallisation

(c) Fractional distillation **(d)** Simple distillation

16. Lung diseases are four times more in urban areas than in rural areas. This is due to the presence of

(a) SO_2 **(b)** CO_2

(c) N_2 **(d)** Water vapour

17. Sparingly soluble salt is

(a) KCl **(b)** NaCl

(c) NH_4Cl **(d)** $BaSO_4$

18. Liquids show viscosity which is due to

(a) Creation of friction between the layers of the fluid **(b)** Inter molecular attraction forces of the liquid

(c) Inter molecular repulsion forces of the liquid **(d)** Both (A) and (B)

19. In the series ethane, ethylene and acetylene, the $C-H$ bond energy is

(a) The same in all the three compounds **(b)** Greatest in ethane

(c) Greatest in ethylene **(d)** Greatest in acetylene

20. In order to decompose 9 g of water 142.5 kJ of heat is required. Hence the enthalpy of formation of water is

(a) – 142.5 kJ **(b)** + 142.5 kJ

(c) –285 kJ **(d)** + 285 kJ

INTEGER TYPE

21. Calculate osmotic pressure (in atm) of 5% solution of cane sugar (sucrose) at 15°C.

22. A sample of 0.50 g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 mL of 0.5 M H_2SO_4. The residual acid required 60 mL of 0.5 M solution of NaOH for neutralisation. Find the percentage composition of nitrogen in the compound.

23. Number of chiral centres in Penicillin is

24. What is the wavelength (in nm) associated with an electron moving with a velocity of 10^6 m/s ? (given $h = 6.63 \times 10^{-34}$ J s and $m = 9.11 \times 10^{-31}$ kg)

25. White phosphorus reacts with chlorine and the product hydrolyses in the presence of water. Calculate the mass (in g) of HCl obtained by the hydrolysis of the product formed by the reaction of 62 g of white phosphorus with chlorine in the presence of water.

Subject : Mathematics

MCQ SINGLE CORRECT

26. Which of the following is not true?

(a) $\sim (p \leftrightarrow q) \equiv (p \wedge \sim q) \vee (\sim p \wedge q)$

(b) $p \rightarrow (q \wedge r) \equiv (p \rightarrow q) \wedge (p \rightarrow r)$

(c) $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow p \rightarrow r$ is a tautology

(d) $(p \wedge \sim q) \leftrightarrow (p \rightarrow q)$ is a tautology

27. Equations of the plane through (1, 3, 5) and having d. c s of its normal as α, β, γ is

(a) $\alpha x + \beta y + \gamma z = \alpha + 3\beta + 5\gamma$

(b) $\frac{x-1}{\alpha} + \frac{y-3}{\beta} + \frac{z-5}{\gamma} = 0$

(c) $\alpha x + \beta y + \gamma z = 1$

(d) $\frac{\alpha x}{1} + \frac{\beta y}{3} + \frac{\gamma z}{4} = 0$

28. A bag '*A*' contains 2 white and 3 red balls and bag '*B*' contains 4 white and 5 red balls. One ball is drawn at random from a randomly chosen bag and is found to be red. The probability that it was drawn from bag '*B*' was

(a) $\frac{5}{14}$

(b) $\frac{5}{16}$

(c) $\frac{5}{18}$

(d) $\frac{25}{52}$

29. The mean deviation from the data, 3, 10, 10 4, 7, 10 , 5 from the mean is

(a) 2

(b) 2.57

(c) 3

(d) 3.75

30. The system of equations

$2x + 6y + 11 = 0,\ 6y - 18z + 1 = 0$

$6x + 20y - 6z + 3 = 0$

(a) is consistent

(b) has unique solution

(c) is inconsistent

(d) cannot be determined

31. If $R = \{(x, y) : x, y \in N, y$ is the remainder when x is divided by 7$\}$. Then sum of all numbers in range of R is

(a) 14

(b) 21

(c) 28

(d) 12

32. ${}^{n}P_{r}$ and ${}^{n}C_{r}$ are equal when

(a) n = r **(b)** n = r + 1

(c) r = 1 **(d)** n = r – 1

33. If the probability distributkion of a random variable x is as given below

X(= x) :	–2	–1	0	1	2	3
P(x = x) :	$\frac{1}{10}$	K	$\frac{1}{5}$	2k	$\frac{3}{10}$	k

Then the value of k is

(a) $\frac{1}{10}$ **(b)** $\frac{2}{10}$

(c) $\frac{3}{10}$ **(d)** $\frac{7}{10}$

34. Six coins are tossed simultaneously. The probability of getting atleast 4 heads is

(a) $\frac{11}{64}$ **(b)** $\frac{11}{32}$

(c) $\frac{15}{44}$ **(d)** $\frac{21}{32}$

35. The sum of divisors of $2^5.3^4$ is

(a) $\frac{2^5-1}{2-1}.\frac{3^4-1}{3-1}$ **(b)** $\frac{2^6-1}{2-1}.\frac{3^5-1}{3-1}$

(c) $\frac{2^4-1}{2-1}.\frac{3^3-1}{3-1}$ **(d)** $2^5.3^4$

36. The points $A(-1,3,0)$, $B(2,2,1)$ and $C(1,1,3)$ determine a plane. The distance from the plane to the point $D(5,7,8)$ is

(a) $\sqrt{66}$ **(b)** $\sqrt{71}$

(c) $\sqrt{73}$ **(d)** $\sqrt{76}$

37. Bag *A* contains 4 green and 3 red balls and bag *B* contains 4 red and 3 green balls. One bag is taken at random and a ball is drawn and noted it is green. The probability that it comes bag *B*

(a) $\frac{2}{7}$ **(b)** $\frac{2}{3}$

(c) $\frac{3}{7}$ **(d)** $\frac{1}{3}$

38. If ${}^nC_1 + 2.\ {}^nC_2 + \ldots n\ .\ {}^nC_n = 2n^2$, then n =

(a) 4 **(b)** 7

(c) 3 **(d)** 1

39. If A, B, C are the angles of a triangle ABC is given by equation 5 cos A + 3 = 0, then sin A and tan A are the roots of the equation

(a) $15x^2 - 8x - 16 = 0$ **(b)** $15x^2 - 8\sqrt{2}\,x + 16 = 0$

(c) $15x^2 - 8x + 16 = 0$ **(d)** $15x^2 + 8x + 16 = 0$

40. A fair die is tossed eight times. The probability that a third six is observed on the 8th throw is

(a) $\frac{{}^7C_2 \times 5^5}{6^7}$ **(b)** $\frac{{}^7C_2 \times 5^5}{6^8}$

(c) $\frac{{}^7C_2 \times 5^3}{6^6}$ **(d)** none of these

41. There are 'p' points in space of which 'q' points are coplanar. Then the number of planes formed is

(a) ${}^pC_3 - {}^qC_3$ **(b)** ${}^pC_3 - {}^qC_{3+1}$

(c) ${}^pC_2 - {}^qC_2 + 1$ **(d)** ${}^pC_3 - {}^qC_2$

42. If the area of a triangle is $a^2 - (b - c)^2$ then $\tan \frac{A}{2} =$

(a) $\frac{1}{4}$ **(b)** $\frac{1}{2}$

(c) $\frac{3}{4}$ **(d)** 0

43. The matrix $\begin{pmatrix} 1 & a & 2 \\ 1 & 2 & 5 \\ 2 & 1 & 1 \end{pmatrix}$ is not invertible, if 'a' has the value

(a) 2 **(b)** 1

(c) 0 **(d)** -1

44. In any triangle ABC, the simplified form of $\frac{\cos 2A}{a^2} - \frac{\cos 2B}{b^2}$ is

(a) $a^2 - b^2$ **(b)** $\frac{1}{a^2 - b^2}$

(c) $\frac{1}{a^2}-\frac{1}{b^2}$

(d) $a^2 + b^2$

45. $\frac{1}{1^3}+\frac{1+2}{1^3+2^3}+\frac{1+2+3}{1+2^3+3^3}+.....$ to n terms =

(a) $\frac{2}{n+1}$

(b) $\frac{2n}{n+1}$

(c) $\frac{n}{n+1}$

(d) $\frac{1}{n+1}$

INTEGER TYPE

46. If the point (1, 3) and (5, 1) are two opposite vertices of a rectangle and the other two vertices lie on the line. y = 2 x + c, then the value of c is :

47. If $2x^2+(a-10)x+\frac{33}{2}=2a, a\in Z^+$ has real roots, then minimum value of 'a' is equal to

48. If a line makes angles α, β and γ with coordinates then cos 2α + cos 2β + cos 2γ =

49. Find the co-efficient of z^4 in the expansion of $(5 + z)^8$

50. Let the line y = mx intersects the curve $y^2 = x$ at P and tangent to $y^2 = x$ at P intersects x-axis at Q. If area (ΔOPQ) = 4, find m (m > 0

Subject : Physics

MCQ SINGLE CORRECT

51. A satellite is revolving round the earth. Its kinetic energy is E_k. How much should it be made so that the satellite may escape out of the gravitational field of earth–

(a) $2E_k$

(b) $3E_K$

(c) $E_K/2$

(d) Infinity

52. When a resistance of 2 *ohm* is connected across the terminals of a cell, the current is 0.5 *A*. When the resistance is increased to 5 *ohm*, the current is 0.25 *A*. The e.m.f. of the cell is

(a) 1.0 *V*

(b) 1.5 *V*

(c) 2.0 *V*

(d) 2.5 *V*

53. The truth-table given below is for which gate

A	0	0	1	1
B	0	1	0	1
C	1	1	1	0

(a) XOR

(b) OR

(c) AND

(d) NAND

54. One requires 11 eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in

(a) visible region **(b)** infrared region

(c) ultraviolet region **(d)** microwave region

55. A stone tied to string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. the magnitude of the change in its velocity as it reached a position where the string is horizontal is

(a) $\sqrt{u^2 - 2gL}$ **(b)** $\sqrt{2gL}$

(c) $\sqrt{u^2 - gl}$ **(d)** $\sqrt{2\left(u^2 - gL\right)}$

56. A watch based on an oscillating spring is taken to the moon. It will

(a) Go fast **(b)** go slow

(c) Show the correct time **(d)** first go slow and then fast

57. A small body of mass m slides without friction from the top of a hemisphere of radius r. At what height will the body be detached from the centre of the hemisphere?

(a) $h = \frac{r}{2}$ **(b)** $h = \frac{r}{3}$

(c) $h = \frac{2r}{3}$ **(d)** $h = \frac{r}{4}$

58. A train is moving on a straight track with speed 20 ms^{-1}. It is blowing its whistle at the frequency of 1000 Hz. The percentage change in the frequency heard by a person standing near the track as the train passes him is (speed of sound = 320 ms^{-1}) close to :

(a) 12% **(b)** 18%

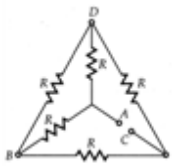
(c) 24% **(d)** 6%

59. An automobile's safety system requires that an audible signal is produced so that driver can start driving when the ignition switch is on and the door is properly shut. The logic gate which can be used to activate the audio signal is

(a) OR **(b)** NOT

(c) AND **(d)** NAND

60. Each of the resistances in the network shown in figure equals R. Find the resistance between two terminals A and C



(a) 2RΩ

(b) $\frac{R}{2}\Omega$

(c) RΩ

(d) $R^2\Omega$

61. A satellite revolves around the earth in an elliptical orbit. Its speed

(a) Is the same at all points in the orbit

(b) Is greatest when it is closest to the earth

(c) Is greatest when it is farthest from the earth

(d) Goes on increasing or decreasing continuously depending upon the mass of the satellite

62. If the force applied is F and the velocity gained is v, then the power developed is

(a) $\frac{F}{v}$

(b) $\frac{v}{F}$

(c) Fv

(d) Fv^2

63. An electron is projected along the axis of a circular conductor carrying some current. Electron will experience force :

(a) along the axis

(b) perpendicular to the axis

(c) at an angle of 4^o with axis

(d) no force experienced

64. The orbital velocity of a satellite revolving close to earth's surface is –

(a) 2.4 Km/s

(b) 11.2Km/s

(c) 8 Km/s

(d) 3.1 Km/s

65. A body of mass 0.98 kg is suspended from a spring of spring constant k = $\frac{2N}{m}$ then the time period id

(a) 4.9 sec

(b) 4.4 sec

(c) 5.2 sec

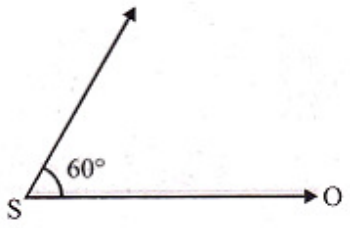
(d) none

66. An electromagnetic radiation has an energy 14.4 KeV. To which region of electromagnetic spectrum does it belong?

(a) Infra red region **(b)** Visible region

(c) X-rays region **(d)** ray region

67. A source of sound S emitting waves of frequency 100 Hz and an observer O are located at some distance from each other. The source is moving with a speed of 19.4 ms^{-1} at an angle of 60° with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer is (velocity of sound in air $330\ ms^{-1}$)



(a) 103 Hz **(b)** 106 Hz

(c) 97 Hz **(d)** 100 Hz

68. A body is moving in a vertical circle of radius r such that the string is just taut at its highest point. The speed of the particle when the string is horizontal is

(a) $\sqrt{gr}$ **(b)** $\sqrt{2gR}$

(c) $\sqrt{3gR}$ **(d)** $\sqrt{4gR}$

69. The elongation of a spring of length 'L' and of negligible mass due to a force is 'x'. The spring is cut into two pieces of length in ratio 1 : n. The ratio of the respective spring constants is

(a) n : 1 **(b)** 1 : n

(c) n^2 : 1 **(d)** 1 : n^2

70. A proton, a neutron, an electron and an α-particle have same energy. Then, their de-Broglie wavelengths compare as

(a) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$ **(b)** $\lambda_\alpha < \lambda_p = \lambda_n > \lambda_e$

(c) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$ **(d)** $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$

INTEGER TYPE

71. An electric kettle- was marked 500 W, 230 V and was found to raise 1 kg of water at 15° C to the boiling point in 15 minutes. The heat efficiency (in %) of the kettle is

72. A shell of mass 0.020 kg is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 ms^{-1}, what is the recoil speed of the gun (in m/s) ?

73. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value of time period. His percentage error in the measurement of g by the relation g = $4\pi^2 (l / T^2)$ will be :

74. Toricelli's barometer used mercury. Pascal duplicated it using French wine of density 984 kg m^{-3}. Determine the height (in m) of the wine column for normal atmospheric pressure.

75. Calculate the temperature (in K) at which the rms velocity of a gas triples its value at S.T.P.