SOLUTIONS & ANSWERS FOR KEAM ENTRANCE -2021
PAPER 1
VERSION- A4

[PHYSICS & CHEMISTRY]

PHYSICS

1. Eddy currents are not used in the application of

Ans: thermal generators

Sol: Basic concept

2. The total intensity of earth's magnetic field at the poles is 7 units. -------

Ans: 7 units

Sol: At the poles Bv = B & Bh = 0 but at the equator Bh = B & Bv=0. This implies at the equator the magnetic intensity should be 7 units

3. Electromagnetic wave against their detection devices are matched below. -------

Ans: Ultraviolet rays- Thermopiles

Sol: Photocells and photographic films are used for detection of ultraviolet rays

4. In an electromagnetic wave, the oscillating electric and magnetic field vectors are -------

Ans: Mutually perpendicular directions and are in phase

Sol: Basic concept

5. Fresnel distance for an aperture of size a illuminated by a parallel beam -------

Ans: $\frac{a^2}{\lambda}$

Sol: Basic concept

6. The apparent depth of a needle lying in a water beaker is found -------

Ans: 8

Sol: $\mu = \frac{\text{Real depth}}{\text{App. depth}} \Rightarrow \frac{\mu_1}{\mu_2} = \frac{Ad_2}{Ad_1}$

$\frac{4/3}{3/2} = \frac{x}{9} \Rightarrow x = 8$ cm

7. An object is placed at 10 cm in front of a concave mirror. If the image is at 20 cm -------

Ans: –2

Sol: $m = -(v/u) = -(\frac{-20}{-10}) = -2$

8. In Young's double-slit experiment, two different light beams of wavelengths -------

Ans: $\frac{3}{2}$

Sol: $\beta = \frac{\lambda D}{d} \Rightarrow \frac{\beta_1}{\beta_2} = \frac{\lambda_1}{\lambda_2} = \frac{3}{2}$

9. If θ_p is the polarizing angle for a glass plate of refractive index □ and critical angle -------

Ans: $\tan\theta_p \sin\theta_c = 1$

Sol: $\mu = tan\ \theta_p = \frac{1}{sin\theta_c} \Rightarrow tan\ \theta_p\ sin\ \theta_c = 1$

10. Two materials A and B having respective work functions 3 eV and 4 eV are emitting -------

Ans: 400

Sol: $E = \phi + KE_{max}$

$\therefore E_A = 3 + 1 = 4$ eV

$E_B = 4 + 1 = 5$ eV

$E = \frac{hc}{\lambda} \Rightarrow \frac{\lambda_A}{\lambda_B} = \frac{E_B}{E_A}$

$\lambda_B = 500 \times \frac{4}{5} = 400$ nm

11. If the momentum of an α - particle is half that of a proton, then the ratio between the -------

Ans: $\frac{2}{1}$

Sol: $P_\alpha = \frac{1}{2} P_p \qquad \lambda \propto \frac{1}{p}$

$\therefore \frac{\lambda_\alpha}{\lambda_p} = \frac{P_P}{P_\alpha} = \frac{2P_\alpha}{P_\alpha} = \frac{2}{1}$

12. During β^- decay of a radioactive element there is an increase in its -------

Ans: Proton number

Sol: Basic concept

13. 10^{18} fissions per second is required for producing power of 300 MW in a nuclear -------

Ans: 2×10^{17}

Sol: 300 MW $\rightarrow$ 10^{18} fissions/ sec

60 MW $\rightarrow \frac{60}{300} \times 10^{18} = \frac{1}{5} \times 10^{18}$

$= 2 \times 10^{17}$ fissions/ sec

14. The ratio of the total energy E of the electron to its kinetic energy K in hydrogen-------

Ans: –1

Sol: KE : PE = 1 : -1

15. If the mass numbers of two nuclei are in the ratio 3 : 2, then the ratio of their nuclear ---------

Ans: 1 : 1

Sol: Nuclear density is independent of A

16. In p-type semiconductors ------

Ans: the electron will move from one hole to another hole constituting a flow of current

Sol: Basic concept

17. In a CB mode of a transistor the current through the emitter is 6 mA. -------

Ans: 0.3 mA

Sol: $\alpha = \frac{\Delta I_C}{\Delta I_E} = \frac{I_C}{I_E}$

$\Rightarrow I_C = \alpha I_E = 0.95 \times 6 = 5.7\,mA$

$I_B = I_E - I_C = 6\,mA - 5.7\,mA = 0.3\,mA$

18. The compound semiconductor used for making LEDs of -------

Ans: Gallium Arsenide - Phosphide

Sol: Basic concept

19. A transistor amplifier along with a tank circuit with positive -------

Ans: Oscillator

Sol: Basic concept

20. In a transmitter the audio signal of frequency ω_m is modulated -------

Ans: ω_m and $2\omega_c$

Sol: Basic concept

21. Pick out the INCORRECT statement from the following

Ans: The bandwidth usually allocated to transmit TV signals is 6 MHz

Sol: Option D

22. A physical quantity A on multiplication with velocity results in another -------

Ans: $[M^1 L^1 T]$

Sol: A × velocity = B = Energy

$\therefore A = \frac{\text{Energy}}{\text{Velocity}} = \text{momentum}$

$[A] = \frac{[M^1 L^2 T^{-2}]}{[L^1 T^{-1}]} = [M^1 L^1 T^{-1}]$

23. If the percentage errors in the measurements of mass, length and time are 1%. ----------

Ans: 8%

Sol: $a = \frac{v}{t} = \frac{\lambda}{t^2}$

$\frac{\Delta a}{a} = \frac{\Delta \lambda}{\lambda} + 2\frac{\Delta t}{t} = 2 + 2(3) = 8\,\%$

24. The radius of a circular plate is 1.05 m. Its area (in m^2) up----------

Ans: 3.47

Sol: Basic concept

25. The velocity of a moving particle at any instant is $\hat{i} + \hat{j}$. The magnitude --------

Ans: $\sqrt{2}$ units and 45° with the x-axis

Sol: $\overline{V} = \hat{i} + \hat{j}$

$\left|\overline{V}\right| = \sqrt{1^2 + 1^2} = \sqrt{2}$ units

$\tan\alpha = \frac{V_y}{V_n} = \frac{1}{1} = 1$

$\Rightarrow \alpha = 45°$ with x-axis

26. A hammer is dropped into a mine. Its velocities at depths d, 2d----------

Ans: $1 : \sqrt{2} : \sqrt{3}$

Sol: $V = \sqrt{2gh}$

$V_1 = V_2 = V_3 = 1 : \sqrt{2} : \sqrt{3}$

27. The stopping distance of a moving vehicle is proportional to the ---------

Ans: square of the initial velocity

Sol: $F \bullet S = \frac{1}{2}mV^2 = \frac{1}{2}mU^2$

$S \propto V^2$ [F is const]

28. When a body starts from rest and moves with a constant acceleration, the velocity-time --------

Ans: A

Sol: V = at

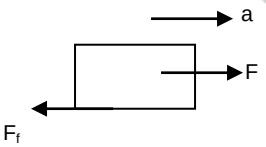
$V \propto t$

Straight line

29. A wooden block of mass 10 kg is moving with an acceleration of 3 ms^{-2} on a rough floor.--------

Ans: 60 N

Sol:



$F - F_f = ma$

$F = F_f + ma$

$= \mu mg + ma$

$= m[g\mu + a]$

$= 10\,[10 \times 0.3 + 3] = 10\,[6] = 60$ N

30. Which one of the following statement is INCORRECT?

Ans: A net force is needed to keep a body in uniform motion

Sol: To keep body in uniform motion, $F_{net} = 0$

31. On a conveyor belt moving with a speed u, sand falls at a constant rate

Ans: $u\left(\frac{dm}{dt}\right)$

Sol: $F = \frac{dm}{dt}u$

32. Area under the force-time graph gives the change in----------

Ans: Impulse

Sol: Area under F – t graph gives change in momentum/impulse

33. When a metal spring is elongated within its elastic limit ----------

Ans: Potential energy is stored in it

Sol: Basic concept

34. The instantaneous power in terms of force F and instantaneous velocity----------

Ans: $P = F \bullet v$

Sol: $P = \vec{F} \bullet \vec{V}$

35. A ball with 10^3 J of kinetic energy collides with a horizontally ----------

Ans: 8×10^3 Nm^{-1}

Sol: $\frac{1}{2}mv^2 = \frac{1}{2}Kx^2$

$\frac{1}{2}Kx^2 = 10^3$

$K = 2 \times 10^3 / (50 \times 10^{-2})^2 = 8 \times 10^3$

36. An object released from certain height h from the ground rebounds to a height ----------

Ans: $\frac{3}{4}$

Sol: $\frac{mgh - mgh/4}{mgh} = \frac{3}{4}$

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37. A solid metal ring and a disc of same radius and mass are ---------

Ans: 2 : 1

Sol: $$\frac{KE_{ring}}{KE_{Disc}} = \frac{\frac{1}{2}\left[\frac{MR^2}{2}\right]\omega^2}{\frac{1}{2}\left[\frac{MR^2}{4}\right]\omega^2} = \frac{4}{2} = 2:1$$

38. The X and Y coordinates of the three particles of masses m, 2m and 3m are respectively----------

Ans: $\frac{-2}{3}$

Sol: $$X_{cm} = \frac{m(0)+2m(1)+3m(-2)}{m+2m+(3m)}$$
$$= \frac{2m-6m}{6m} = \frac{-4}{6} = \frac{-2}{3}$$

39. Radius of gyration of a solid cylinder of radius R and length L about its long ----------

Ans: $\frac{R}{\sqrt{2}}$

Sol: $\frac{MR^2}{2} = MK^2$

$K = \frac{R}{\sqrt{2}}$

40. When no external torque acts on a rotating system------

Ans: its rotational kinetic energy is inversely proportional to moment of inertia

Sol: $T = \frac{dL}{dt}; \quad T = 0$

L is const

$KE = \frac{L^2}{2I}; \; KE \propto \frac{1}{I}$

41. If T be the time period of a planet around the Sun----------

Ans: $T^2 \propto d^3$

Sol: $T^2 \propto d^3$

42. If the earth shrinks to half of its present size and its mass ----------

Ans: 2g

Sol: Given M' = $\frac{M}{2}$ and R' = $\frac{R}{2}$

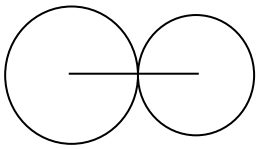
We know $g = \frac{GM}{R^2}$

$$\therefore g' = \frac{G\left(M/2\right)}{\left(R/2\right)^2} = \frac{GM}{2R^2} \times 4 = \frac{2GM}{R^2} = 2g$$

43. When two identical spheres each of radius r are kept----------

Ans: r^4

Sol:



$\rho = mV$

$$F = \frac{G\left[\rho\frac{4}{3}\pi r^3\right]\left[\rho\frac{4}{3}\pi r^3\right]}{(2r)^2}$$

$F \propto \frac{r^6}{r^2} \propto r^4$

44. With the increase of temperature
(A) Surface tension of liquid increases ---------

Ans: Both the surface tension and viscosity of liquid decrease

Sol: Basic concept

45. The TRUE statement is
(A) Young's modulus of a wire------

Ans: $\frac{1}{K}$

Sol: $C = \frac{1}{K}$

46. When a body is strained, energy stored per unit volume --------

Ans: $\frac{(stress)^2}{2Y}$

Sol: $E = \frac{1}{2} \times stress \times strain$

$$= \frac{1}{2} \times stress \times \frac{stress}{Y} = \frac{(stress)^2}{2Y}$$

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47. According to equation of continuity when a liquid flows through a----------

Ans: **av**

Sol: rate of flow is constant

48. Two thermally insulated identical vessels A and B are connected ----------

Ans: temperature and internal energy of the gas remain the same

Sol: Basic concept

49. A process in which there is no flow of heat between the system and surroundings is ------

Ans: Adiabatic process

Sol: Adiabatic process [$\Delta Q = 0$]

50. When the temperature of the source of a Carnot engine is ----------

Ans: 2000 K

Sol: $\eta = 1 - \frac{T_L}{T_H}$

$\frac{1}{4} = 1 - \frac{T_L}{400} \Rightarrow \frac{T_L}{400} = \frac{3}{4}$

T_L = 300 K --------(1)

$\frac{1}{2} = 1 - \frac{300}{T_H} \Rightarrow \frac{300}{T_H} = \frac{1}{2}$

T_H = 600 K ------(2)

T_H (initial) = 400 (η = ¼)

T_H (final) = 600 (η = ½)

Increase = 600 – 400 = 200 K

51. When an ideal diatomic gas is heated at constant pressure, ----------

Ans: $\frac{5}{3}$

Sol: $\Delta H = nC_p \Delta T$

$\Delta U = nC_V \Delta T$

$\frac{\Delta H}{\Delta U} = \frac{C_p}{C_v} = \frac{\frac{5}{2}R}{\frac{3}{2}R} = \frac{5}{3}$

52. The ratio of the kinetic energy values of 4 g of hydrogen----------

Ans: 1 : 1

Sol: KE $\propto$ T

53. A planet with radius R and acceleration due to gravity g, ----------

Ans: $\sqrt{2gR}$

Sol: $V_{\Delta c} = \sqrt{2gR}$

54. If the ratio of the acceleration due to gravity on the surface of earth----------

Ans: $\frac{1}{\sqrt{6}}$

Sol: $T \propto \frac{1}{\sqrt{g}}$

$\frac{T_e}{T_m} = \sqrt{\frac{gm}{ge}} = \frac{1}{\sqrt{6}}$

55. The velocity of a transverse wave propagating on a stretched string ----------

Ans: 1.5

Sol: $v = \frac{\omega}{k} = \frac{\pi \times 3}{2 \times \pi} = \frac{3}{2} = 1.5$

56. The kinetic energy of a particle of mass m executing ----------

Ans: $\frac{a}{\sqrt{2}}$

Sol: $\frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(a^2 - x^2) = \frac{1}{4}m\omega^2 a^2$

$x = \frac{a}{\sqrt{2}}$

57. When two sound waves of slightly different frequencies f_1 ----------

Ans: $\frac{1}{f_1 - f_2}$

Sol: No. of beats/ s = $f_1 - f_2$

58. The electric potential at a point at a distance r due to an ----------

Ans: r^{-2}

Sol: Basic concept

59. An air capacitor and identical capacitor filled with dielectric medium----------

Ans: 2

Sol: $V \propto \frac{1}{C}$

$\frac{V_1}{V_2} = \frac{5}{1}$

$V_1 = \frac{5}{6} \times 12 = 10V$

$V_2 = 2V$

60. The ratio of the magnitudes of electrostatic force between----------

Ans: 1 : 1

Sol: $\frac{F_p}{F_e} = \frac{1}{1}$

61. When two charges are kept in air medium, at certain ----------

Ans: 2

Sol: $F \rightarrow \frac{F}{2} \Rightarrow K = 2$

62. The magnitude of the drift velocity per unit electric field----------

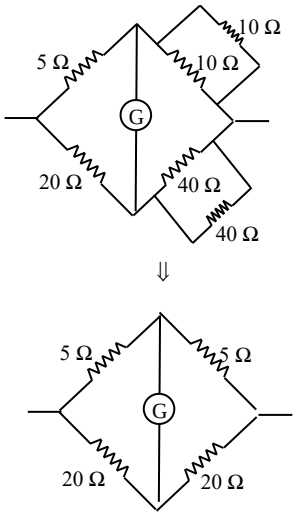
Ans: Mobility

Sol: Basic concept

63. A Wheatstone network is balanced with respective----------

Ans: 10 Ω across Q

Sol: $\frac{P}{K} = \frac{Q}{S} = \frac{1}{4}$



64. If one cell is connected wrongly in a series combination of four----------

Ans: 2 Ω

Sol: $r_{net} = 4 \times 0.5 = 2\ \Omega$

65. A carbon resistor is marked with the rings coloured blue----------

Ans: $60 \times 10^2 \pm 10\%$

Sol: Blue Black red silver
$60 \times 100 + 10\%$

66. A conductor of length 20 cm carrying a current of 5A----------

Ans: 0.25

Sol: $F = Bil \sin 30°$

$= 0.5 \times 5 \times 0.2 \times \frac{1}{2} = 0.25\ N$

67. A current carrying coil placed in a magnetic field B experiences ----------

Ans: τ is zero and φ is maximum for $\theta = 0°$

Sol: Basic concept

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68. In Cyclotron, the frequency of revolution of the charged particle----------

Ans: Oscillatory frequency

Sol: Basic concept

69. The hard ferromagnetic material among the -------

Ans: Alnico

Sol: Basic concept

70. If B_C is the magnetic induction at the centre of a circular coil----------

Ans: $\frac{B_C}{2\sqrt{2}}$

Sol: $B = \frac{\mu_0 Ir^2}{2\left(r^2+x^2\right)^{3/2}} = \frac{\mu_0}{2} \times \frac{Ir^2}{\left(2r^2\right)^{3/2}}$

$= \frac{\mu_0 I}{2\times 2\sqrt{2}r} = \left(\frac{\mu_0 I}{2r}\right)\frac{1}{2\sqrt{2}}$

$= \frac{B_C}{2\sqrt{2}}$

71. If air core is replaced by an iron core in an inductor, its self-inductance is ----------

Ans: 2000

Sol: $L_0 = \frac{\mu_0 N^2 A}{e} = 0.02\,mH$

$L = \frac{\mu N^2 A}{e} = 40\,mH$

$\frac{\mu_0}{\mu} = \frac{0.02}{40}$

$\mu_r = \frac{\mu}{\mu_0} = \frac{40}{2\times 10^{-2}} = 20\times 10^2 = 2000$

72. Among various circuits constructed with resistor R, inductor L and capacitor C, the ---------

Ans: Purely resistive circuit

Sol: Power VI cos ϕ

Power$_{max}$ when cos ϕ = 1 $\Rightarrow$ ϕ = 0

CHEMISTRY

73. The increasing order of acid strength of the following carboxylic acid is ------

Ans: $ClCH_2{-}CH_2{-}COOH$ < $ClCH_2COOH$ < $NC{-}CH_2COOH$ < $CHCl_2\,COOH$

Sol: The increasing order of acid strength of the following carboxylic acids is
$CHCl_2COOH > NC{-}CH_2{-}COOH >$
$ClCH_2COOH > ClCH_2CH_2COOH$

74. Which one of the following is not correct with ------

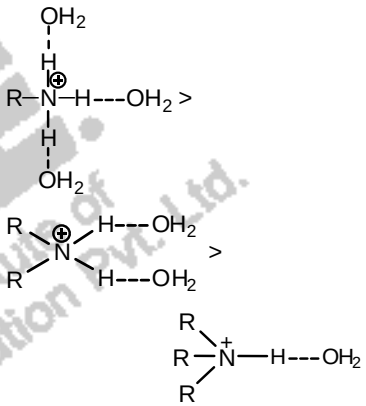
Ans: Ethanamide on reaction with Br_2 and NaOH gives ethylamine

Sol: $CH_3-CONH_2 \xrightarrow{Br_2/NaOH} \underset{\text{methanamine}}{CH_3-NH_2}$

75. The increasing of extent of H-bonding of the alkyl ammonium ------

Ans: $R_3NH^+ < R_2NH_2^+ < RNH_3^+$

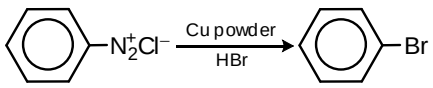
Sol:



76. The conversion of benzene diazonium chloride to bromobenzene by ------

Ans: Gattermann reaction

Sol: Gattermann reaction



77. Which one of the following statements is TRUE with regard to glucose? ------

Ans: Its pentaacetae does not react with NH_2OH

Sol: The pentaacetate of glucose does not react with hydroxylamine indicating the absence of free –CHO group

78. Fibrous protein present in muscles is ---------

Ans: myosin

Sol: The fibrous proteins present in muscles in myosin

79. The drug used to inhibit the enzymes which catalyse the degradation ------

Ans: phenelzine

Sol: Iproniazid and phenelzine are two important antidepressant drugs which inhibit the enzymes that catalyse the degradation of noradrenaline

80. The gas which is the major contributor to global warming is ------

Ans: CO_2

Sol: CO_2 is the major contributor to global warming

81. A cooking gas contains carbon and hydrogen only. A volume of 11.2 L of this gas ------

Ans: C_3H_8

Sol: 11.2 L of gas $\Rightarrow$ 22 g
$\therefore$ 22.4 L of gas $\Rightarrow$ 44 g
Hence molecular wt. of the gas
= 44 g mol^{-1}
$\therefore$ The hydrocarbon is C_3H_8

82. The number of electrons in an atom that may have the quantum numbers ------

Ans: 9

Sol: No. of orbitals in n = 3 is $n^2 = 9$ orbitals
$\therefore$ Total no. of electrons in n = 3 and
$m_s = \frac{1}{2}$ =9 electrons

83. "No two electrons in an atom can have the same set of four quantum numbers". This ------

Ans: Pauli's exclusion principle

Sol: Statement of Pauli's exclusion principle

84. The first ionization enthalpy is the least in ------

Ans: Bismuth

Sol: The first ionization enthalpy of
Ge – 761 kJ mol^{-1} Sb – 834 kJ mol^{-1}
Te – 869 kJ mol^{-1} As – 947 kJ mol^{-1}
Bi – 703 kJ mol^{-1}

85. Predict in which of the following, entropy decreases: ------

Ans: **A** liquid crystallizes into a solid

Sol: When liquid changes to solid its randomness decreases. Hence entropy decreases

86. In which one of the following, sp^2 hybridisation is involved in the central atom? ------

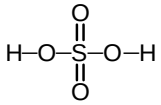
Ans: BCl_3

Sol: In BCl_3, the central atom boron undergoes sp^2 hybridisation
NH_3 – sp^3
ClF_3 – sp^3d
PCl_3 – sp^3
PH_3 – sp^3

87. In which one of the following molecules, the central atom has expanded octet? ------

Ans: Sulphuric acid

Sol: In sulphuric acid, the central atom sulphur contains 12 electrons i.e., an expanded octet



88. A cycle tube will burst if the volume of air inside exceeds 1L at the room temperature ------

Ans: 0.5 bar

Sol: At constant temperature,
$P_1V_1 = P_2V_2$
$1 \times 500 = P_2 \times 1000$
$P_2 = \frac{500}{1000} = 0.5$ bar

89. The ratio of the actual molar volume of a gas to the ideal molar volume is _____ of the gas.

Ans: compressibility factor

Sol: Compressibility factor $Z = \frac{PV}{nRT}$

For 1 mol, $Z = \frac{V_{real}}{V_{ideal}}$

90. Enthalpy change is always negative for which one of the following processes?

Ans: Enthalpy of combustion

Sol: Enthalpy of combustion is always negative

91. The enthalpy change for the evaporation of a liquid at its boiling point 127°C is ------

Ans: +37 kJ mol^{-1}

Sol: 1 mol liquid $\xrightarrow{127^\circ C}$ 1 mol vapour

$\Delta H = \Delta U + \Delta nRT$

$\therefore \Delta U = \Delta H - \Delta nRT$

$= 40.32 - 1 \times 8.3 \times 10^{-3} \times 400$

$= 40.32 - 3.32 = +37 \text{ kJ mol}^{-1}$

92. In which one of the following equilibria ------

Ans: $H_{2(g)} + Br_{2(g)} \rightleftharpoons 2HBr_{(g)}$

Sol: $H_{2(g)} + Br_{2(g)} \rightleftharpoons 2HBr_{(g)}$

$\Delta n_g = 2 - (1 + 1) = 0$

93. The following concentrations were obtained for the formation of ------

Ans: $5 \times 10^3 \text{ mol}^{-2} \text{ dm}^6$

Sol: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$= \frac{(2\times10^{-2})^2}{(1\times10^{-2})(2\times10^{-2})^3}$$

$$= \frac{1}{1\times10^{-2}\times2\times10^{-2}} = \frac{10^4}{2}$$

$= 0.5 \times 10^4 = 5000$

$= 5 \times 10^3 \text{ mol}^{-2} \text{ dm}^6$

94. The SI unit of molar conductivity is ------

Ans: $S \text{ m}^2 \text{ mol}^{-1}$

Sol: The SI unit of molar conductivity is $S \text{ m}^2 \text{ mol}^{-1}$

95. Which of the following is an example of disproportionation redox reaction?

Ans: $2NO_{2(g)} + 2OH^- \rightarrow NO^-_{2(aq)} + H_2O_{(\lambda)}$

Sol: $\overset{+4}{2NO_{2(g)}} + 2OH^- \rightarrow \overset{+3}{NO^-_{2(aq)}} + \overset{+5}{NO^-_{3(aq)}} + H_2O_{(\lambda)}$

96. A scientist wants to perform an experiment in aqueous solution in a hill station where the ------

Ans: 240 g

Sol: $$\Delta T_b = \frac{K_b \times W_B \times 1000}{M_B \times W_A}$$

$$\therefore W_B = \frac{(100 - 98.98)\times 60 \times 2000}{0.51 \times 1000}$$

$$= \frac{1.02 \times 120}{0.51} = 240 \text{ g}$$

97. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. ------

Ans: 340 g mol^{-1}

Sol: $$\frac{P^o_A - P_S}{P^o_A} = \frac{W_B \times M_A}{M_B \times W_A}$$

$$= \frac{0.850 - 0.845}{0.850} = \frac{1 \times 78}{M_B \times 39}$$

$$\therefore M_B = \frac{2 \times 0.85}{0.005} = 340 \text{ g mol}^{-1}$$

98. For the reaction $2P + Q \rightleftharpoons P_2Q$, the rate of formation of ------

Ans: $-0.48 \text{ mol dm}^{-3} \text{ s}^{-1}$ and $-0.24 \text{ mol dm}^{-3} \text{ s}^{-1}$

Sol: $2P + Q \rightleftharpoons P_2Q$

$$\text{rate} = \frac{1}{2}\frac{-\Delta[P]}{\Delta t} = \frac{-\Delta[Q]}{\Delta t} = \frac{\Delta[P_2Q]}{\Delta t}$$

Given, $\frac{\Delta[P_2Q]}{\Delta t} = 0.24 \text{ mol dm}^{-3} \text{ s}^{-1}$

$$\therefore \frac{\Delta[P]}{\Delta t} = 2 \times \frac{\Delta[P_2Q]}{\Delta t} = 2 \times 0.24$$

$= 0.48 \text{ mol dm}^{-3} \text{ s}^{-1}$

$$\frac{-\Delta[Q]}{\Delta t} = 0.24 \text{ mol dm}^{-3} \text{ s}^{-1}$$

99. Choose the correct set of reactions which follow first order kinetics: ------

Ans: ii, iii, v

Sol: Thermal decomposition of $N_2O_{5(g)}$ at constant volume, hydrogenation of ethene, thermal decomposition of $SO_2Cl_{2(g)}$ at constant volume are first order reactions

Thermal decomposition of HI on gold surface and decomposition of NH_3 on a hot Pt surface are zero order reactions

100. Which one of the following is true?

Ans: Both physisorption and chemisorption depend on the nature of the gas

Sol: Both physisorption and chemisorption depend on the nature of the gas

101. When zinc metal is reacted with aqueous sodium hydroxide, the products formed are ------

Ans: sodium zincate and hydrogen only

Sol: $Zn + 2NaOH \rightarrow \underset{\text{sodium zincate}}{Na_2ZnO_2} + H_2$

102. 'Syngas' produced from sewage is a gaseous mixture of------

Ans: CO and H_2

Sol: The mixture of CO and H_2 is called water gas or synthesis gas or 'syn gas'

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103. Choose the correct choice containing true statements regarding PCl_5. ------

Ans: i and ii

Sol: In gaseous and liquid phase, PCl_5 has trigonal bipyramidal structure. The three equational P–Cl bonds are equivalent and two axial bonds are longer than equatorial bonds.

104. Match the substances and their uses. ------

Ans: a-(iv), b-(i), c-(v), d-(iii), e-(ii)

Sol: Silicones – Water proofing of fabrics
Zeolites – Cracking of hydrocarbons
Quartz – Flux for soldering metals
Boron fibres – Light composite material for aircrafts

105. Choose the wrong statement in the following with regard to orthoboric acid:

Ans: It is freely soluble in cold water

Sol: It is sparingly soluble in water but highly soluble in hot water

106. The magnetic moment of a trivalent ion of a metal with *Z*=24 in aqueous solution ------

Ans: 3.87 BM

Sol: M^{3+} (Z = 24) – [Ar] $3d^3$

$\therefore$ Number of unpaired electrons (n) = 3

$\therefore$ Magnetic moment, $\mu = \sqrt{n(n+2)}$ BM

$= \sqrt{3(3+2)}$ = 3.87 BM

107. In the first row transition metals, the element that exhibits only +3 oxidation state is------

Ans: scandium

Sol: In the 3d series, Sc exhibits only +3 oxidation state

108. The metal that has the highest melting point in the first series of transition elements is------

Ans: vanadium

Sol: Vanadium has the highest melting point among the 3d elements due to its high enthalpy of atomisation value

109. In which one of the following complexes, the conductivity corresponds to 1:2 ------

Ans: Pentaamminechlorocobalt(III) chloride

Sol: $[Co(NH_3)_5Cl]Cl_2 \rightarrow [Co(NH_3)_5Cl]^{2+} + 2Cl^-$

110. The complex ion formed when the film developed in black and white ------

Ans: $[Ag(S_2O_3)_2]^{3-}$

Sol: In black and white photography, the developed film is fixed by washing with hypo solution which dissolves the undecomposed AgBr to form a complex ion $[Ag(S_2O_3)_2]^{3-}$

111. Which one of the following is an ore of aluminium?

Ans: Kaolinite

Sol: Kaolinite – $[Al_2(OH)_4Si_2O_5]$
Siderite – $FeCO_3$
Malachite – $CuCO_3.Cu(OH)_2$
Calamine – $ZnCO_3$
Haemetite – Fe_2O_3

112. In the estimation of nitrogen present in an organic compound, ------

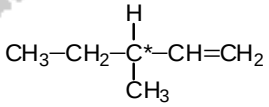
Ans: pyridine

Sol: Kjeldahl's method is not applicable to compounds containing nitrogen in nitro and azo groups and nitrogen present in the ring as nitrogen of these compounds does not change to ammonium sulphate under these conditions.

113. Among the following the alkene that exhibits optical isomerism is

Ans: 3-methyl-1-pentene

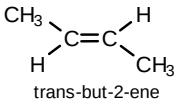
Sol: 3-Methyl-1-pentene contains a chiral carbon



114. The reagent that is used to convert but-2-yne to trans–but-2-ene is

Ans: Na /liquid NH_3

Sol: $CH_3 - C \equiv C - CH_3 \xrightarrow[liq.NH_3]{Na}$

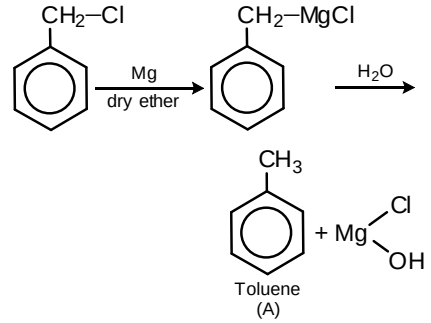


trans-but-2-ene

115. Compound 'A' is obtained by the reaction of benzyl chloride with magnesium metal ------

Ans: Toluene

Sol:



116. The correct increasing order of boiling points of the following compounds is------

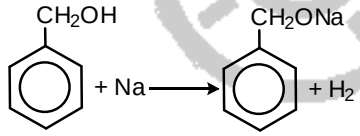
Ans: $CH_3Cl < CH_3Br < CH_2Br_2 < CHBr_3$

Sol: With the increase in size and mass of halogen atom, the magnitude of vander Waals forces increases and hence boiling point also increases. Thus, the BP is of the order,
$CH_3Cl < CH_3Br < CH_2Br_2 < CHBr_3$

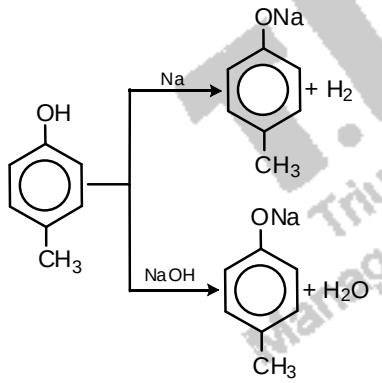
117. Compound 'A', 'B' and 'C' have the same molecular formula C_7H_8O. Compound ------

Ans: Benzyl alcohol, cresol and anisole

Sol: Compound (A) is Benzyl alcohol



Compound (B) is Cresol

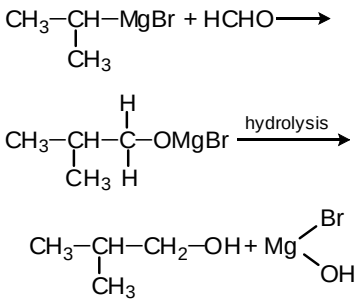


Compound (C) is anisole. It is inert to both Na and NaOH

118. The suitable Grignard reagent used for the preparation of 2-methylpropan-1-ol using methanal is

Ans: $CH_3–CH(CH_3)–MgBr$

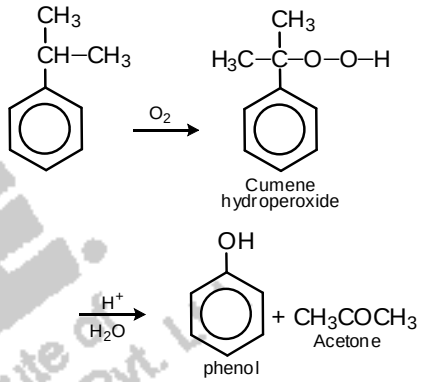
Sol:



119. Isopropylbenzene (cumene) is oxidized in the presence of air to give compound 'X' which on hydrolysis in the ------

Ans: cumene hydroperoxide, phenol, aceton

Sol:



120. A research scholar returned to the laboratory after the lock down due to Covid-19. He kept acetone, benzaldehyde, ------

Ans: P-acetone, Q-benzaldehyde,
R-acetaldehyde, S-diethyl ketone

Sol: Aceone (P) and acetaldehyde (R) answers iodoform test
Acetaldehyde only answers Fehling's reagent test
Benzaldehyde (Q) and acetaldehyde (R) answers Tollen's test
Diethyl ketone (S) did not answer any test