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[Q. Booklet Number]


Aakash Institute | **Aakash IIT-JEE**
 Premier Institute in India for Medical Entrance Exams.

(Divisions of Aakash Educational Services Ltd.)

KOLKATA

WB-JEE - 2009

**PHYSICS & CHEMISTRY
QUESTIONS & ANSWERS**

1. One Kg of copper is drawn into a wire of 1mm diameter and a wire of 2 mm diameter. The resistance of the two wires will be in the ratio
 (A) 2:1 (B) 1:2 (C) 16:1 (D) 4:1

Ans : (C)

Hints : Mass = $(\pi r_1^2 \ell_1) \sigma$ (1st wire)

Mass = $(\pi r_2^2 \ell_2) \sigma$ (2nd wire)

$$(\pi r_1^2 \ell_1) \sigma = (\pi r_2^2 \ell_2) \sigma$$

$$\frac{\ell_1}{\ell_2} = \left(\frac{r_2}{r_1} \right)^2$$

$$\frac{R_1}{R_2} = \frac{\rho \frac{\ell_1}{A_1}}{\rho \frac{\ell_2}{A_2}} = \frac{\ell_1}{\ell_2} \times \frac{A_2}{A_1} = \frac{\ell_1}{\ell_2} \times \left(\frac{r_2}{r_1} \right)^2$$

$$= \left(\frac{r_2}{r_1} \right)^4$$

$$\Rightarrow 16:1$$

2. An electrical cable having a resistance of 0.2Ω delivers 10kw at 200V D.C. to a factory. What is the efficiency of transmission?
 (A) 65% (B) 75% (C) 85% (D) 95%

Ans : (D)

Hints : $P = VI \Rightarrow I = \frac{10 \times 10^3}{200} = 50 A$, Power loss = $(50)^2 (0.2) = 500W$

$$\text{Efficiency} = \frac{10000 \times 100}{10000 + 500} = 95.23\%$$

3. A wire of resistance $5\ \Omega$ is drawn out so that its new length is 3 times its original length. What is the resistance of the new wire?
 (A) $45\ \Omega$ (B) $15\ \Omega$ (C) $5/3\ \Omega$ (D) $5\ \Omega$

Ans : (A)

Hints : $\left(\frac{r_1}{r_2}\right)^2 = \left(\frac{l_2}{l_1}\right) = \frac{3l}{l} = 3$

$\left(\frac{R_2}{R_1}\right) = \frac{l_2}{l_1} \times \frac{A_1}{A_2} = 3 \times \left(\frac{r_1}{r_2}\right)^2 = 3 \times 3 \Rightarrow R_2 = 45$

4. Two identical cells each of emf E and internal resistance r are connected in parallel with an external resistance R . To get maximum power developed across R , the value of R is
 (A) $R=r/2$ (B) $R=r$ (C) $R=r/3$ (D) $R=2r$

Ans : (A)

Hints : $R_{eq} = \frac{r}{2} + R = \frac{r+2R}{2}$

$I = \frac{2E}{r+2R}$

For max. power consumption, I should be max. So denominator should be min. for that

$r+2R = (\sqrt{r}-\sqrt{2R})^2 + 2\sqrt{r}\sqrt{2R} \Rightarrow \sqrt{r}-\sqrt{2R} = 0 \Rightarrow R = r/2$

5. To write the decimal number 37 in binary, how many binary digits are required?
 (A) 5 (B) 6 (C) 7 (D) 4

Ans : (B)

Hints :

2	37	1
2	18	0
2	9	1
2	4	0
2	2	0
1		1

$(100101) \Rightarrow 6\ \text{digits}$

6. A junction diode has a resistance of $25\ \Omega$ when forward biased and $2500\ \Omega$ when reverse biased. The current in the diode, for the arrangement shown will be



- (A) $\frac{1}{15}\ \text{A}$ (B) $\frac{1}{7}\ \text{A}$ (C) $\frac{1}{25}\ \text{A}$ (D) $\frac{1}{180}\ \text{A}$

Ans : (B)

Hints : $R_{eq} = 25 + 10 = 35\ \Omega$

Because diode is forward biased. So $I = \frac{V}{R_{eq}} = \frac{5}{35} = \frac{1}{7}\ \text{A}$



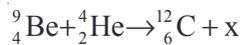
7. If the electron in a hydrogen atom jumps from an orbit with level $n_1 = 2$ to an orbit with level $n_2 = 1$ the emitted radiation has a wavelength given by
 (A) $\lambda = 5/3R$ (B) $\lambda = 4/3R$ (C) $\lambda = R/4$ (D) $\lambda = 3R/4$

Ans : (B)

Hints : $\frac{1}{\lambda} = R \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) = R \left(\frac{1}{1^2} - \frac{1}{2^2} \right) = \frac{3R}{4}$

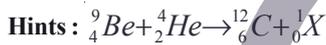
$\Rightarrow \lambda = \frac{4}{3R}$

8. What is the particle x in the following nuclear reaction :



- (A) electron (B) proton (C) Photon (D) Neutron

Ans : (D)



Hence X represents neutron (1_0n)

9. An alternating current of rms value 10 A is passed through a 12 Ω resistor. The maximum potential difference across the resistor is

- (A) 20V (B) 90V (C) 1969.68V (D) none

Ans : (C)

Hints : $I_{\text{rms}} = 10\text{A}$

$I_{\text{rms}} = \frac{I_0}{\sqrt{2}} \Rightarrow I_0 = \sqrt{2} \times 10 = 10\sqrt{2}$

Max. P.D. = $\sqrt{2} \times 10 \times 12 = 120 \times 1.414 = 169.68 \text{ V}$

10. Which of the following relation represent Biot-Savart's law?

- (A) $d\vec{B} = \frac{\mu_0}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^3}$ (B) $d\vec{B} = \frac{\mu_0}{4\pi} \frac{d\vec{l} \times \hat{r}}{r^3}$ (C) $d\vec{B} = \frac{\mu_0}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^3}$ (D) $d\vec{B} = \frac{\mu_0}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^4}$

Ans : (C)

Hints : $d\vec{B} = \frac{\mu_0}{4\pi} \frac{I(d\vec{l} \times \vec{r})}{r^3}$

Note : - In question paper current (I) is missing

11. \vec{A} and \vec{B} are two vectors given by $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = \hat{i} + \hat{j}$. The magnitude of the component of \vec{A} along \vec{B} is

- (A) $\frac{5}{\sqrt{2}}$ (B) $\frac{3}{\sqrt{2}}$ (C) $\frac{7}{\sqrt{2}}$ (D) $\frac{1}{\sqrt{2}}$

Ans : (A)

Hints : Magnitude of components of \vec{A} along $\vec{B} = \frac{\vec{A} \cdot \vec{B}}{|\vec{B}|} = \frac{(2\hat{i} + 3\hat{j}) \cdot (\hat{i} + \hat{j})}{\sqrt{2}} = \frac{5}{\sqrt{2}}$



12. Given $\vec{C} = \vec{A} \times \vec{B}$ and $\vec{D} = \vec{B} \times \vec{A}$. What is the angle between \vec{C} and \vec{D} ?
 (A) 30° (B) 60° (C) 90° (D) 180°

Ans : (D)

Hints : \vec{C} and \vec{D} are antiparallel since $\vec{A} \times \vec{B} = -(\vec{B} \times \vec{A})$

13. The acceleration 'a' (in ms^{-2}) of a body, starting from rest varies with time t (in s) following the equation $a = 3t + 4$. The velocity of the body at time $t = 2\text{s}$ will be
 (A) 10 ms^{-1} (B) 18 ms^{-1} (C) 14 ms^{-1} (D) 26 ms^{-1}

Ans : (C)

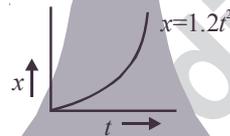
Hints : $a = 3t + 4$

$$\frac{dV}{dt} = 3t + 4$$

$$\int_0^V dV = \int_0^t (3t + 4) dt$$

$$V = \frac{3t^2}{2} + 4t = \frac{12}{2} + 8 = 14 \text{ m/s}$$

14. Figure below shows the distance-time graph of the motion of a car. It follows from the graph that the car is



- (A) at rest (B) in uniform motion
 (C) in non-uniform acceleration (D) uniformly accelerated

Ans : (D)

Hints : Slope is increasing with constant rate. i.e motion is uniformly accelerated

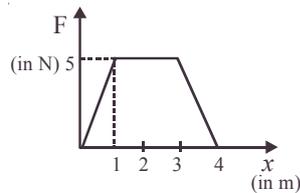
$$x = 1.2t^2 \Rightarrow v = 2.4t \Rightarrow a = 2.4 \text{ m/s}^2$$

15. Two particles have masses m & 4m and their kinetic energies are in the ratio 2: 1. What is the ratio of their linear momenta ?
 (A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{16}$

Ans : (A)

Hints : $\frac{KE_1}{KE_2} = \frac{\frac{p_1^2}{2m}}{\frac{p_2^2}{2 \times 4m}} = \frac{2}{1} \Rightarrow \frac{p_1}{p_2} = \frac{1}{\sqrt{2}}$

16. The force F acting on a particle moving in a straight line is shown below. What is the work done by the force on the particle in the 1st meter of the trajectory ?

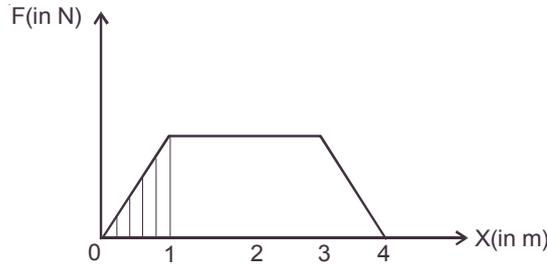


- (A) 5J (B) 10J (C) 15J (D) 2.5J



Ans : (D)

Hints : Work done in 1 meter = area of shaded curve = $\frac{1}{2} \times 1 \times 5 = 2.5 \text{ J}$



17. If the kinetic energy of a body changes by 20% then its momentum would change by –
 (A) 20% (B) 24% (C) 40% (D) 44%

Ans : (No answer matching)

Hints :
$$\frac{\frac{p_f^2}{2m} - \frac{p_i^2}{2m}}{\frac{p_i^2}{2m}} \times 100 = 20$$

$$\Rightarrow \frac{p_f}{p_i} = \sqrt{1.2} = 1.095 \Rightarrow \frac{p_f - p_i}{p_i} = 0.095$$

Therefore % increase = 9.5%

18. A bullet is fired with a velocity u making an angle of 60° with the horizontal plane. The horizontal component of the velocity of the bullet when it reaches the maximum height is
 (A) u (B) 0 (C) $\frac{\sqrt{3}u}{2}$ (D) $\frac{u}{2}$

Ans : (D)

Hints : Horizontal velocity would be constant so the value of velocity at the highest point will be $u/2$

19. A particle is projected at 60° to the horizontal with a kinetic energy K . The kinetic energy at the highest point is
 (A) K (B) zero (C) $\frac{K}{4}$ (D) $\frac{K}{2}$

Ans : (C)

Hints : At highest point kinetic energy = $\frac{1}{2}m (v \cos 60^\circ)^2 = \frac{1}{4} \times \frac{1}{2}m v^2 = K/4$

20. The poisson's ratio of a material is 0.5. If a force is applied to a wire of this material, there is a decrease in the cross-sectional area by 4%. The percentage increase in the length is :
 (A) 1% (B) 2% (C) 2.5% (D) 4%

Ans : (D)

Hints : Poisson ratio = 0.5

Therefore density is constant hence change in volume is zero we have

$V = A \times \ell = \text{constant}$

$\log V = \log A + \log \ell$ or $\frac{dA}{A} + \frac{d\ell}{\ell} = 0 \Rightarrow \frac{d\ell}{\ell} = -\frac{dA}{A}$

That is 4%



21. Two spheres of equal masses but radii r_1 and r_2 are allowed to fall in a liquid of infinite column. The ratio of their terminal velocities is

- (A) 1 (B) $r_1 : r_2$ (C) $r_2 : r_1$ (D) $\sqrt{r_1} : \sqrt{r_2}$

Ans : (Data incomplete)

Hints : We have $v_T = \frac{2r^2(\sigma - \rho)g}{9\eta}$

$$\frac{v_1}{v_2} = \left(\frac{r_1}{r_2}\right)^2 \frac{(\sigma_1 - \rho)}{(\sigma_2 - \rho)} ; \text{ given } m_1 = m_2 \Rightarrow \left(\frac{r_1}{r_2}\right)^3 = \frac{\sigma_2}{\sigma_1}$$

22. Two massless springs of force constants K_1 and K_2 are joined end to end. The resultant force constant K of the system is

- (A) $K = \frac{K_1 + K_2}{K_1 K_2}$ (B) $K = \frac{K_1 - K_2}{K_1 K_2}$ (C) $K = \frac{K_1 K_2}{K_1 + K_2}$ (D) $K = \frac{K_1 K_2}{K_1 - K_2}$

Ans : (C)

Hints : In series $K_{\text{eff}} = \frac{K_1 K_2}{K_1 + K_2}$

23. A spring of force constant k is cut into two equal halves. The force constant of each half is

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

Ans : (D)

Hints : As $K \ell = \text{constant}$

$$K' = 2K$$

24. Two rods of equal length and diameter have thermal conductivities 3 and 4 units respectively. If they are joined in series, the thermal conductivity of the combination would be

- (A) 3.43 (B) 3.5 (C) 3.4 (D) 3.34

Ans : (A)

Hints : In series $R = R_1 + R_2$

$$\frac{2\ell}{K_{\text{eff}} A} = \frac{\ell}{K_1 A} + \frac{\ell}{K_2 A}$$

$$K_{\text{eff}} = \frac{24}{7} = 3.43$$

25. 19 g of water at 30°C and 5 g of ice at -20°C are mixed together in a calorimeter. What is the final temperature of the mixture? Given specific heat of ice = $0.5 \text{ cal g}^{-1}(\text{C}^\circ)^{-1}$ and latent heat of fusion of ice = 80 cal g^{-1}

- (A) 0°C (B) -5°C (C) 5°C (D) 10°C

Ans : (C)

Hints : $5 \times .5 \times 20 + 5 \times 80 + 5t = 19 \times 1 \times (30 - t)$

$t = 5^\circ\text{C}$



32. The equation of state for n moles of an ideal gas is $PV = nRT$, where R is a constant. The SI unit for R is
 (A) JK^{-1} per molecule (B) $\text{JK}^{-1} \text{mol}^{-1}$ (C) $\text{JKg}^{-1} \text{K}^{-1}$ (D) $\text{JK}^{-1} \text{g}^{-1}$
Ans : (B)
Hints : $\text{JK}^{-1} \text{mol}^{-1}$
33. At a certain place, the horizontal component of earth's magnetic field is $\sqrt{3}$ times the vertical component. The angle of dip at that place is
 (A) 30° (B) 60° (C) 45° (D) 90°
Ans : (A)
Hints : $\tan \theta = \frac{V}{H} = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^\circ$
34. The number of electron in 2 coulomb of charge is
 (A) 5×10^{29} (B) 12.5×10^{18} (C) 1.6×10^{19} (D) 9×10^{11}
Ans : (B)
Hints : $n = \frac{2}{1.6 \times 10^{-19}} = 12.5 \times 10^{18}$
35. The current flowing through a wire depends on time as $I = 3t^2 + 2t + 5$. The charge flowing through the cross section of the wire in time from $t = 0$ to $t = 2$ sec. is
 (A) 22 C (B) 20 C (C) 18 C (D) 5 C
Ans : (A)
Hints : $Q = \int_0^2 (3t^2 + 2t + 5) dt = 22 \text{ C}$
36. If the charge on a capacitor is increased by 2 coulomb, the energy stored in it increases by 21%. The original charge on the capacitor is
 (A) 10 C (B) 20 C (C) 30 C (D) 40 C
Ans : (B)
Hints : $\frac{\frac{q_f^2}{2C} - \frac{q_i^2}{2C}}{\frac{q_i^2}{2C}} \times 100 = 21$ and $q_f - q_i = 2$
 $\frac{q_f^2 - q_i^2}{q_i^2} = 21$
 solving we get $q_i = 20$ coulomb
37. The work done in carrying a charge Q once around a circle of radius r about a charge q at the centre is
 (A) $\frac{qQ}{4\pi\epsilon_0 r}$ (B) $\frac{qQ}{4\pi\epsilon_0} \frac{1}{\pi r}$ (C) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{1}{2\pi r} \right)$ (D) 0
Ans : (D)
Hints : Work done by conservative force in a round trip is zero
38. Four capacitors of equal capacitance have an equivalent capacitance C_1 when connected in series and an equivalent capacitance C_2 when connected in parallel. The ratio $\frac{C_1}{C_2}$ is:
 (A) 1/4 (B) 1/16 (C) 1/8 (D) 1/12
Ans : (B)
Hints : $C_1 = \frac{C}{4}$ and $C_2 = 4C \Rightarrow \frac{C_1}{C_2} = \frac{1}{16}$



39. Magnetic field intensity H at the centre of a circular loop of radius r carrying current I e.m.u is
 (A) r/I oersted (B) $2\pi I/r$ oersted (C) $I/2\pi r$ oersted (D) $2\pi I$ oersted

Ans : (B)

Hints : $H = \frac{\mu_0 I}{2r} = \frac{\mu_0}{4\pi} \times \frac{2\pi I}{r}$

In e.m.u system $\frac{\mu_0}{4\pi} = 1$. So $H = \frac{2\pi I}{r}$

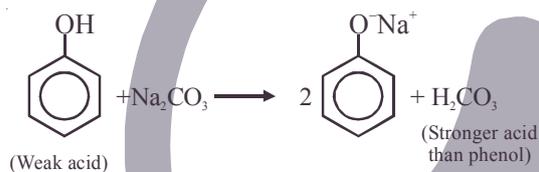
40. Which of the following materials is the best conductor of electricity?
 (A) Platinum (B) Gold (C) Silicon (D) Copper

Ans : (D)

41. Which statement is incorrect
 (A) Phenol is a weak acid (B) Phenol is an aromatic compound
 (C) Phenol liberates CO_2 from Na_2CO_3 soln (D) Phenol is soluble in NaOH

Ans : (C)

Hints : Phenol does not liberate CO_2 from Na_2CO_3 solution

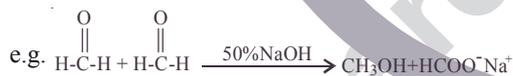


Note : Strong acid is not formed by weak acid

42. In which of the following reactions new carbon-carbon bond is not formed :
 (A) Cannizaro reaction (B) Wurtz reaction (C) Aldol condensation (D) Friedel-Craft reaction

Ans : (A)

Hints : In cannizaro's reaction no new C-C bond is formed



43. A compound is formed by substitution of two chlorine for two hydrogens in propane. The number of possible isomeric compounds is
 (A) 4 (B) 3 (C) 5 (D) 2

Ans : (C)

Hints : $\text{C}_3\text{H}_8 \xrightarrow[-2\text{H}]{+2\text{Cl}} \text{C}_3\text{H}_6\text{Cl}_2$, following isomers of $\text{C}_3\text{H}_6\text{Cl}_2$ is possible



Due to presence of chiral carbon compound (IV) is optically active and forms an enantiomer. So total no of isomers =5

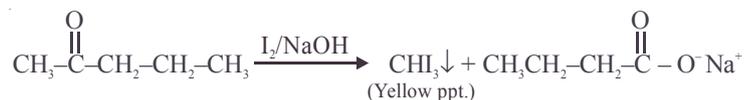
44. Which one of the following is called a carbylamine?
 (A) R-CN (B) R-CONH_2 (C) R-CH=NH (D) RNC

Ans : (D)



45. For making distinction between 2-pentanone and 3-pentanone the reagent to be employed is
 (A) $K_2Cr_2O_7/H_2SO_4$ (B) $Zn-Hg/HCl$ (C) SeO_2 (D) Iodine/NaOH

Hints : In 2-pentanone *ie.*, $CH_3-\overset{\overset{O}{\parallel}}{C}-CH_2CH_2CH_3$, $CH_3-\overset{\overset{O}{\parallel}}{C}-$ group is present due to which it can show iodoform test. *i.e.*,



46. Which one of the following formulae does not represent an organic compound?
 (A) $C_4H_{10}O_4$ (B) $C_4H_8O_4$ (C) $C_4H_7ClO_4$ (D) $C_4H_9O_4$
Ans : (D)

Hints : Unsaturation factor = 0, 1, 1, 0.5 Hence (D)

47. The catalyst used for olefin polymerization is
 (A) Ziegler-Natta Catalyst (B) Wilkinson Catalyst (C) Raney nickel catalyst (D) Merrifield resin
Ans : (A)

Hints : $TiCl_3 + (C_2H_5)_3Al$

48. The oxidant which is used as an antiseptic is :
 (A) $KBrO_3$ (B) $KMnO_4$ (C) CrO_3 (D) KNO_3
Ans : (B)
49. Which of the following contributes to the double helical structure of DNA
 (A) hydrogen bond (B) covalent bond (C) disulphide bond (D) van-der Waal's force
Ans : (A)

50. The monomer used to produce orlon is
 (A) $CH_2=CHF$ (B) $CH_2=CCl_2$ (C) $CH_2=CHCl$ (D) $CH_2=CH-CN$
Ans : (D)

Hints : Orlon or PAN

Monomer $\Rightarrow CH_2=CH-CN$

51. 1 mole of photon, each of frequency $2500 S^{-1}$, would have approximately a total energy of :
 (A) 1 erg (B) 1 Joule (C) 1 eV (D) 1 MeV
Ans : (A)

Hints : Total Energy = $Nh\nu = 6.022 \times 10^{23} \times 6.626 \times 10^{-34} J.S. \times 2500 s^{-1} = 9.9 \text{ erg} \approx 10 \text{ erg}$

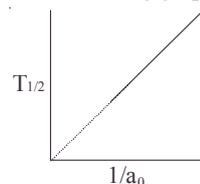
In (A) option, it should be 10 erg instead of 1 erg.

52. If n_t number of radioatoms are present at time t, the following expression will be a constant :
 (A) n_t/t (B) $\ln n_t/t$ (C) $d \ln n_t/dt$ (D) $t.n_t$
Ans : (C)

Hints : $-\frac{dN}{dt} = \lambda N \Rightarrow -\frac{d \ln N}{dt} = \lambda$

Hence (C)

53. The following graph shows how $T_{1/2}$ (half-life) of a reactant R changes with the initial reactant concentration a_0 .



The order of the reaction will be :

- (A) 0 (B) 1 (C) 2 (D) 3



59. Which of the following will decrease the pH of a 50 ml solution of 0.01 M HCl?
 (A) addition of 5 ml of 1 M HCl (B) addition of 50 ml of 0.01 M HCl
 (C) addition of 50 ml of 0.002 M HCl (D) addition of Mg

Ans : (A)

Hints : 50 ml 0.01 M \equiv 50 \times 0.01 = 0.5 millimole
 5 ml 1 (M) \equiv 5 \times 1 = 5 millimole
 Total millimoles = 5.5 millimole
 Total volume = 55 ml.

$$\text{Molarity} = \frac{5.5}{55} = 0.1(\text{M}) = 10^{-1} (\text{M})$$

$$\text{pH} = 1$$

60. Equal volumes of molar hydrochloric acid and sulphuric acid are neutralised by dilute NaOH solution and x kcal and y kcal of heat are liberated respectively. Which of the following is true?

- (A) $x=y$ (B) $x = \frac{y}{2}$ (C) $x=2y$ (D) none of the above

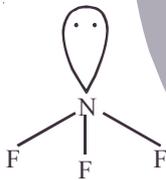
Ans : (B)

Hints : Enthalpy of 1 g equivalent of strong acid and 1 g equivalent strong base = 13.7 kcal
 Equal volume contains double eq. of H_2SO_4 than HCl

61. Hybridisation of central atom in NF_3 is
 (A) sp^3 (B) sp (C) sp^2 (D) dsp^2

Ans : (A)

Hints :



3 σ & 1 lone pair
 Hyb. = sp^3

62. Of the following compounds the most acidic is
 (A) As_2O_3 (B) P_2O_5 (C) Sb_2O_3 (D) Bi_2O_3

Ans : (B)

Hints : In a group as we go downwards, the oxide basic character increases hence maximum acidic oxide is P_2O_5

63. The half-life of a radioactive element is 10 hours. How much will be left after 4 hours in 1 g atom sample?
 (A) 45.6×10^{23} atoms (B) 4.56×10^{23} atoms (C) 4.56×10^{21} atoms (D) 4.56×10^{20} atoms

Ans : (B)

Hints : $t_{1/2} = 10$ hr. $K = \frac{0.693}{10}$

$$4 = \frac{2.303 \times 10}{0.693} \log \frac{1}{N}$$

$$\log \frac{1}{N} = \frac{4 \times 0.693}{2.303 \times 10} = 0.12036$$

$$\log N = -0.12036 = \bar{1}.87964$$

$$N = 7.575 \times 10^{-1} \text{ g atoms}$$

$$\therefore \text{No. of atoms} = 7.575 \times 10^{-1} \times 6.023 \times 10^{23} \text{ atoms} = 4.56 \times 10^{23} \text{ atoms}$$



64. For the Paschen series the values of n_1 and n_2 in the expression $\Delta E = Rhc \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$ are
 (A) $n_1=1, n_2=2, 3, 4, \dots$ (B) $n_1=2, n_2=3, 4, 5, \dots$ (C) $n_1=3, n_2=4, 5, 6, \dots$ (D) $n_1=4, n_2=5, 6, 7, \dots$

Ans : (C)

Hints : In Paschen series electron shifting to third shell i.e., $n_1 = 3$ to $n_2 = 4, 5, 6, \dots$

65. Under which of the following condition is the relation $\Delta H = \Delta E + P\Delta V$ valid for a closed system?
 (A) Constant Pressure (B) Constant temperature
 (C) Constant temperature and pressure (D) Constant temperature, pressure and composition

Ans : (A)

Hints : This is applicable when pressure remains constant.

66. An organic compound made of C, H and N contains 20% nitrogen. Its molecular weight is :
 (A) 70 (B) 140 (C) 100 (D) 65

Ans : (A)

Hints : Nitrogen at. wt. = 14 in a molecule minimum one atom of N is present

i.e., $20\% \equiv 14$

Molecular weight = 70

$100\% \equiv 14 \times 5 = 70$

67. In Cu-ammonia complex, the state of hybridization of Cu^{+2} is
 (A) sp^3 (B) d^3s (C) sp^2f (D) dsp^2

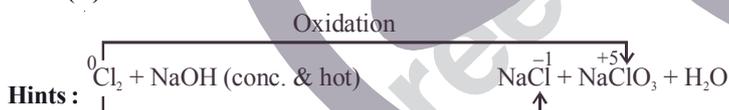
Ans : (D)

Hints : In $[\text{Cu}(\text{NH}_3)_4]^+$

Cu^{+2} is in a state of dsp^2 hybridization and shape of the complex is square planar. (One e^- is excited from $3d$ to $4p$ during complex formation)

68. The reaction that takes place when Cl_2 gas is passed through conc. NaOH solution is :
 (A) Oxidation (B) Reduction (C) Displacement (D) Disproportionation

Ans : (D)



Hence the reaction is disproportionation

69. "Electron" is an alloy of
 (A) Mg and Zn (B) Fe and Mg (C) Ni and Zn (D) Al and Zn

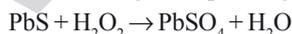
Ans : (A)

Hints : Electron is an alloy of Mg(95%) + Zn(4.5%) and Cu(0.5%)

70. Blackened oil painting can be restored into original form by the action of :
 (A) Chlorine (B) BaO_2 (C) H_2O_2 (D) MnO_2

Ans : (C)

Hints : Blackening of oil painting is due to PbS which is oxidised by H_2O_2 to form white PbSO_4



(Black) (white)

71. Of the following acids the one which has the capability to form complex compound and also possesses oxidizing and reducing properties is :

(A) HNO_3 (B) HNO_2 (C) HCOOH (D) HCN

Ans : (B) HNO_2^{+3}

Hints : Here oxidation state of N lies between -3 to $+5$



PHYSICS

SECTION-II

1 The displacement x of a particle at time t moving under a constant force is $t = \sqrt{x} + 3$, x in meters, t in seconds. Find the work done by the force in the interval from $t = 0$ to $t = 6$ second.

A. $t = \sqrt{x} + 3 \Rightarrow x = (t - 3)^2 \Rightarrow v = 2(t - 3)$
 v at $t = 0$, -6 m/s
 v at $t = 6$ sec., 6 m/s
 change in KE is zero \Rightarrow work done = 0

2 Calculate the distance above and below the surface of the earth at which the acceleration due to gravity is the same

A. $\frac{GM}{(R+h)^2} = \frac{GM(R-h)}{R^3}$
 on solving we get
 $-Rh + R^2 - h^2 = 0$
 $h = \frac{-R + \sqrt{R^2 + 4R^2}}{2} = \frac{(\sqrt{5} - 1)R}{2}$

3 A ray of light travelling inside a rectangular glass block of refractive index $\sqrt{2}$ is incident on the glass-air surface at an angle of incidence of 45° . Show that the ray will emerge into the air at an angle of refraction equal to 90°

A. Given $C = 45^\circ$
 $\sin c = \frac{1}{\mu} = \frac{1}{\sqrt{2}} = \sin 45^\circ$

So the ray will graze the interface after refraction at an angle of 90°

4 Two cells each of same e.m.f 'e' but of internal resistances r_1 and r_2 are connected in series through an external resistance R . If the potential difference between the ends of the first cell is zero, what will be the value of R in terms r_1 and r_2 ?

A. $I = \frac{2e}{r_1 + r_2 + R}$; now $e - Ir_1 = 0$
 $\Rightarrow r_2 - r_1 + R = 0, R = (r_1 - r_2)$

5 At time $t = 0$, a radioactive sample has a mass of 10 gm. Calculate the expected mass of radioactive sample after two successive mean lives.

A. Two successive mean lives = $\frac{2}{\lambda}$

No. of nuclei after two mean lives = $N_0 e^{-\lambda \left(\frac{2}{\lambda}\right)} = \frac{N_0}{e^2}$

Therefore mass = $\frac{10}{e^2}$ gm



CHEMISTRY

SECTION-II

6 Calculate the number of H⁺ ion present in 1 ml of a solution whose pH is 10.

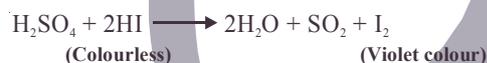
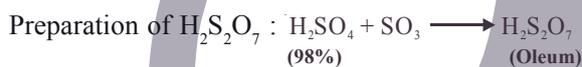
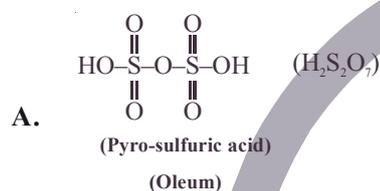
A. pH = 10

$$[H^+] = 10^{-10} \text{ M}$$

In 1000 ml solution there are 6.023×10^{13} H⁺ ions

In 1 ml solution there are 6.023×10^{10} H⁺ ions

7 Give the structure of pyro-sulfuric acid. How would you prepare it? What would you observe when colourless HI is added to pyro-sulfuric acid?

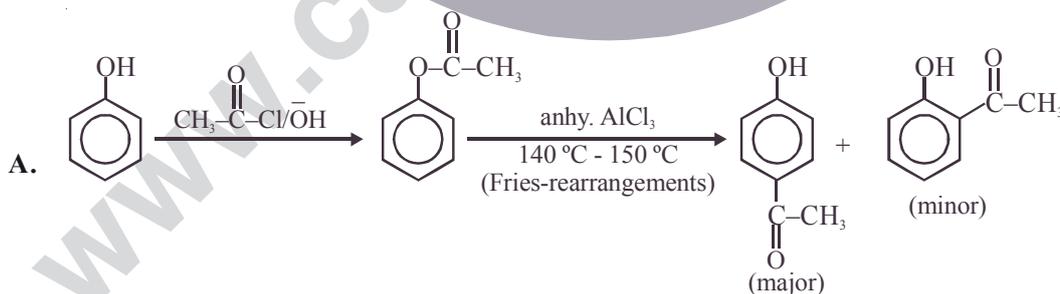


8 Write with a balanced chemical equation how gypsum is used for the conversion of ammonia into ammonium sulfate without using H₂SO₄.

A. Balanced reaction is



9 Convert phenol to p-hydroxy acetophenone in not more than 2 steps.



10 An organic compound 'A' on treatment with ammoniacal silver nitrate gives metallic silver and produces a yellow crystalline precipitate of molecular formula C₉H₁₀N₄O₄, on treatment with Brady's reagent. Give the structure of the organic compound 'A'.



A. Compound (A) is an aldehyde. It should be propanal $\text{CH}_3\text{CH}_2\text{CHO}$

Reactions :

