IIT JEE 2011

Part 1 Chemistry

1. Oxidation states of the metal in the minerals haematite and magnetite, respectively, are

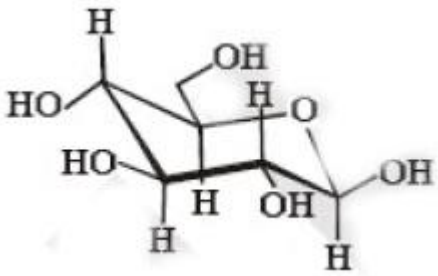
(A) II , III in haematite and III in magnetite

(B) II , III in haematite and II in magnetite

(C) IE in haematite and II , III in magnetite

(D) III in haematite and II , III in magnetite

2. The following carbohydrate is



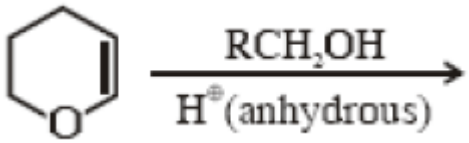
(A) a ketohexose

(B) an aldohexose

(C) an α-furanose

(D) an α-pyranose

3. The major product of the following reaction is



(A) a hemiacetal

(B) an acetal

(C) an ether

(D) an ester

4. Amongst the compounds given, the one that would form a brilliant coloured dye on treatment with $NaNO_2$ in dil. HCl followed by addition to an alkaline solution of β -naphthol is –

(A)

(B)

(C)

(D)

5. The freezing point (in °C) of a solution containing 0.1 g of $K_3\left[Fe(CN)_6\right]$ (Mol.Wt.329) in 100 g of water $\left(K_f = 1.36\ K\ kg\ mol^{-1}\right)$ is -

(A) -2.3×10^{-2}

(B) -5.7×10^{-2}

(C) -5.7×10^{-3}

(D) -1.2×10^{-2}

6. Consider the following cell reaction :

$$2Fe_{(s)} + O_{2(g)} + 4H^+_{(aq)} \rightarrow 2Fe^{2+}_{(aq.)} + 2H_2O(\ell) \quad E^\circ = 1.67\,V$$

At $\left[Fe^{2+}\right] = 10^{-3}M, P(O_2) = 0.1atm$ and $pH = 3$, the cell potential at 25°C is-

(A) 1.47 V

(B) 1.77 V

(C) 1.87 V

(D) 1.57 V

7. Passing H_2S gas into a mixture of $Mn^{2+}, Ni^{2+}, Cu^{3+}$ and Hg^{2+} ions in an acidified aqueous solution precipitates

(A) CuS and HgS

(B) MnS and CuS

(C) MnS and NiS

(D) NiS and HgS

8. Among the following complexes $(K-P)$

$K_3\left[Fe(CN)_6\right](K), \left[Co(NH_3)_6\right]Cl_3(L), Na_3\left[Co(oxalate)_3\right](M), \left[Ni(H_2O)_6\right]Cl_2(N),$
$K_2\left[Pt(CN)_4\right](O)$ and $\left[Zn(H_2O)_6\right](NO_3)_2$ P

The diamagnetic complex are -

(A) K, L, M, N

(B) K, M, O, P

(C) L, M, O, P

(D) L, M, N, O

9. Reduction of The metal centre in aqueous permanganate ion involves -

(A) 3 electrons in neutral medium

(B) 5 elections in neutral medium

(C) 3 electrons in alkaline medium

(D) 5 electrons in acidic medium

10. For the first older reaction

$$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$$

(A) the concentration of the reactant decreases exponentially with time

(B) the half-life of the reaction decreases with increasing temperature.

(C) the half-life of the reaction depends on rue initial concentration of the reactant.

(D) the reaction proceeds to 99.6% completion in eight half-life duration.

11. The equilibrium

$2Cu^{I} \square \quad Cu^{\circ} + Cu^{II}$

in aqueous medium at $25°C$ shifts towards the left in the presence of

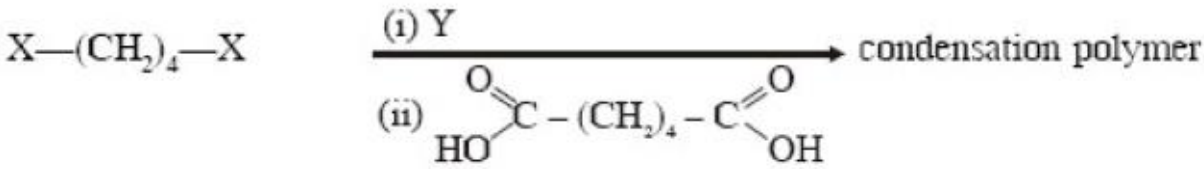
(A) NO_3^-

(B) Cl^-

(C) SCN^-

(D) CN^-

12. The correct functional group X and the reagent/reaction conditions Y in the following scheme are



(A) $X = COOCH_3, Y = H_2/Ni/heat$

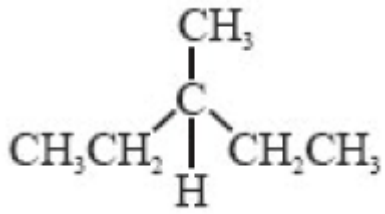
(B) $X = CONH_2, Y = H_2/Ni/heat$

(C) $X = CONH_2, Y = Br_2/NaOH$

(D) $X = CN, Y = H_2/Ni/heat$

13. In 1L saturated solution of $AgCl\left[K_{sp}(AgCl)=1.6\times10-^{10}\right]$, 0.1mol of CuCl $\left[K_{sp}(AgCl)=1.0\times10-^{6}\right]$ is added. The resultant concentration of Ag^{+} in the- solution is 1.6×10^{-x}. The value of 'x' is.

14. The maximum number of isomers (including stereoisomers) that are possible on mono-chlorination of the fallowing compounds, is



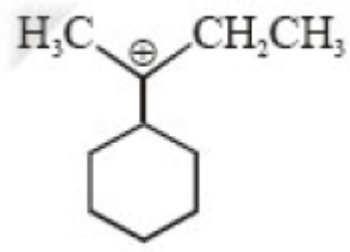
15. Among the following, the number of compounds that can it act with PCl_5 to give $POCl_3$ is

$O_2, CO_2, SO_2, H_2O, H_2SO_4, P_4O_{10}$

16. The number of hexagonal faces that present in a truncated octahedron is.

17. The volume (in mL) of $0.1M\ AgNO_3$, required for complete precipitation of chloride ions present in 30 mL of 0.01M solution of $\left[Cr(H_2O)_5\ Cl\right]Cl_2$, as silver chloride is close to.

18. The total number of r contributing structures showing hyperconjugation (involving $C-H$ bonds) for the following carbocation is.



19. Match the transformations in **Column-I** with appropriate **option** in **Column-II**

Column-I	**Column-II**
(A) $CO_2(s) \rightarrow CO_2(g)$	(p) phase transition
(B) $CaCO_3(g) \rightarrow CaO(s) + CO_2(g)$	(q) allotropic change
(C) $2H\bullet \rightarrow H_2(g)$	(r) ΔH is positive
(D) $P_{(white, solide)} \rightarrow P_{\text{red, solide}}$	(s) ΔS is positive
	(t) ΔS is negative

21. A light ray traveling in glass medium is incident on glass-air interface at an angle of incidence θ . The reflected (R) and transmitted (T) intensities, both as function of θ. are plotted. The correct sketch is

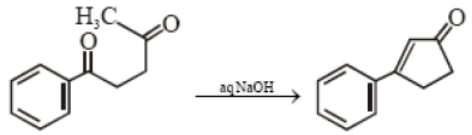
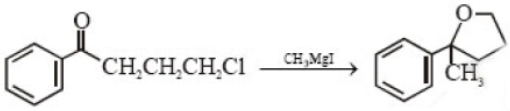
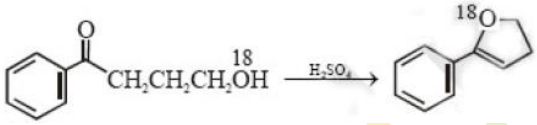
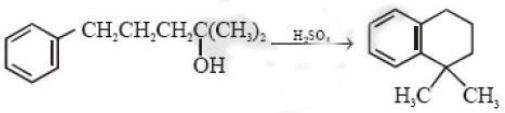
(A)

(B)

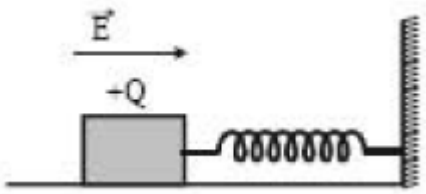
(C)

(D)

20. Match the reactions in **Column-I** with appropriate types of step/reactive intermediate involved in these reactions as given in **Column-II**

Column-I	**Column-II**
(A) 	(p) Nucleophilic substitution
(B) 	(q) Electrophilic substitution
(C) 	(r) Dehydration
(D) 	(s) Nucleophilic addition
	(t) Carbanion

22. A wooden block perform SHM on a frictionless surface with frequency, ν_0. The block carries a charge $+Q$ on its surface. If now a uniform electric field $\vec{E}$ is switched-on as shown, then the SHM of the block win be



(A) of the same frequency and with shifted mean position

(B) of the same frequency and with the same mean position

(C) of changed frequency and with shifted mean position

(D) of changed frequency and with the same mean position

23. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%. the relative percentage error in the density is

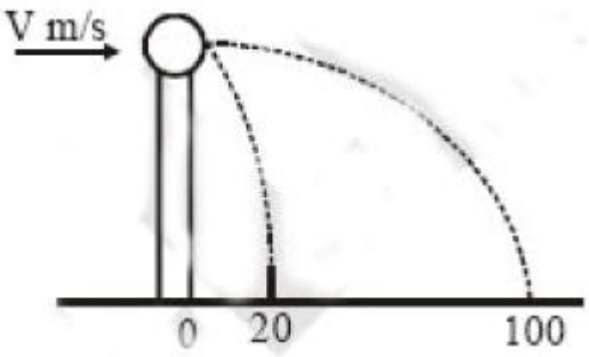
(A) 0.9%

(B) 2.4%

(C) 3.1%

(D) 4.2%

24. A ball of mass 0.2 kg rests on a vertical post of height 5m. A bullet of mass 0.01 kg, traveling with a velocity V m/s in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance of 20 m and the bullet at a distance of 100 m from the foot of the post. The initial velocity V of the bullet is



(A) $250\,\mathrm{m/s}$

(B) $250\sqrt{2}\ \mathrm{m/s}$

(C) $400\,\mathrm{m/s}$

(D) $500\,\mathrm{m/s}$

25. Which of the field patterns given below is valid for electric field as well as for magnetic field?

(A)

(B)

(C)

(D)

26. A point mass is subjected to two simultaneous sinusoidal displacements in x-direction, $x_1(t) = A\sin\omega t$ and $x_2(t) = A\sin\left(\omega t + \frac{2\pi}{3}\right)$. Adding a third sinusoidal displacement $x_3(t) = B\sin(\omega t + \phi)$ brings the mass to a complete rest. The values of B and ϕ are

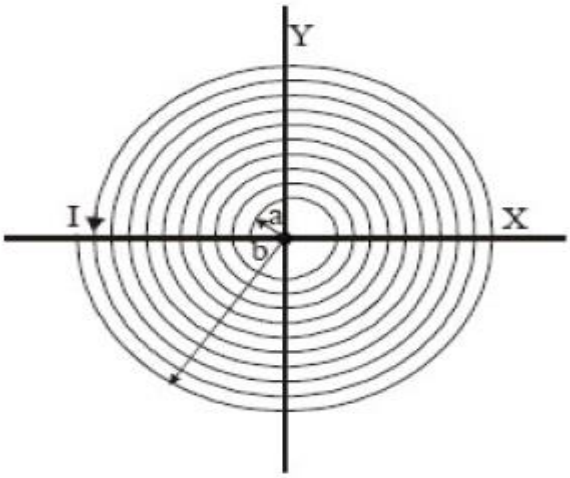
(A) $\sqrt{2}A, \frac{3\pi}{4}$

(B) $A, \frac{4\pi}{3}$

(C) $\sqrt{3}A, \frac{5\pi}{6}$

(D) $A, \frac{\pi}{3}$

27. A long insulated copper wire is closely wound as a spiral of 'N' turns. The spiral has inner radius 'a' and outer radius 'b'. The spiral lies in the $X-Y$ plane and a steady current 'I' flows through the wire. The Z-component of the magnetic field at the center of the spiral is



(A) $\frac{\mu_0 NI}{2(b-a)}\ell n\left(\frac{b}{a}\right)$

(B) $\frac{\mu_0 NI}{2(b-a)}\ell n\left(\frac{b+a}{b-a}\right)$

(C) $\frac{\mu_0 NI}{2b}\ell n\left(\frac{b}{a}\right)$

(D) $\frac{\mu_0 NI}{2b}\ell n\left(\frac{b+a}{b-a}\right)$

28. A satellite is moving with a constant speed 'V' in a circular orbit about the earth. An object of mass 'm' is ejected from the satellite such that it just escapes from the gravitational pull of the earth. At the time of its ejection, the kinetic energy of the object is

(A) $\frac{1}{2}mV^2$

(B) mV^2

(C) $\frac{3}{2}mV^2$

(D) $2mV^2$