# board question paper: march 2013 <br> Chemistry 

Time: 3 Hours
Note:
i. All questions are compulsory.
ii. Answer to the two sections are to be written in the same answer book.
iii. Figure to the right hand side indicate full marks.
iv. Write balanced chemical equations and draw neat and labelled diagrams wherever necessary.
v. Every new question must be started on a new page.
vi. Use of logarithmic table is allowed

## SECTION - I

Q.1. Select and write the most appropriate answer from the given alternatives for each sub-question:
i. In body centred cubic structure, the space occupied is about $\qquad$ .
(A) $68 \%$
(B) $53 \%$
(C) $38 \%$
(D) $32 \%$
ii. For a gaseous reaction, the unit of rate of reaction is $\qquad$
(A) $\mathrm{L} \mathrm{atm} \mathrm{s}^{-1}$
(B) atm mol ${ }^{-1} \mathrm{~s}^{-1}$
(C) $\mathrm{atm} \mathrm{s}^{-1}$
(D) mol s
iii. Which of the following compounds contains $\mathrm{S}=\mathrm{O}$ as well as $\mathrm{S}=\mathrm{S}$ bonds?
(A) Sulphuric acid
(B) Thiosulphuric acid
(C) Sulphurous acid
(D) Thiosulphurous acid
iv. Which of the following solutions shows maximum depression in freezing point?
(A) $0.5 \mathrm{M} \mathrm{Li}_{2} \mathrm{SO}_{4}$
(B) 1 M NaCl
(C) $0.5 \mathrm{M} \mathrm{Al}_{2}\left(\mathrm{SO}_{4}\right)_{3}$
(D) $0.5 \mathrm{M} \mathrm{BaCl}_{2}$
v. For a chemical reaction, $\Delta \mathrm{S}=-0.035 \mathrm{~kJ} / \mathrm{K}$ and $\Delta \mathrm{H}=-20 \mathrm{~kJ}$. At what temperature does the reaction turn non-spontaneous?
(A) 5.14 K
(B) 57.14 K
(C) 571.4 K
(D) 5714.0 K
vi. The standard e.m.f of the following cell is 0.463 V
$\mathrm{Cu}\left|\mathrm{Cu}^{++}(1 \mathrm{M}) \| \mathrm{Ag}^{+}(1 \mathrm{M})\right| \mathrm{Ag}$. If $\mathrm{E}_{\mathrm{Ag}}^{\circ}=0.800 \mathrm{~V}$,
What is the standard potential of Cu electrode?
(A) 1.137 V
(B) 0.337 V
(C) 0.463 V
(D) -0.463 V
vii. $\quad \mathrm{Fe}_{2} \mathrm{O}_{3}$ is reduced to spongy iron near the top of blast furnace by $\qquad$ .
(A) $\mathrm{H}_{2}$
(B) CaO
(C) $\mathrm{SiO}_{2}$
(D) CO
Q. 2. Answer any SIX of the following:
i. Distinguish between crystalline solid and amorphous solid.
ii. State Kohlrausch Law and write mathematical expression of molar conductivity of the given solution at infinite dilution.
iii. Write cell reactions in lead storage battery during discharge.
iv. Draw structures and write geometry of $\mathrm{PCl}_{3}$ and $\mathrm{PCl}_{5}$.
v. Prove that $\Delta H=\Delta U+\Delta n R T$. What is the condition under which $\Delta U=\Delta H$ ?
vi. Mention names and formulae of two ores of aluminium.
vii. Derive the relationship between relative lowering of vapour pressure and molar mass of non-volatile solute.
viii. What is pseudo first order reaction? Give one example of it.

## Q.3. Answer any THREE of the following:

i. Calculate the mole fraction and molality of $\mathrm{HNO}_{3}$ in a solution containing $12.2 \% \mathrm{HNO}_{3}$.
(Given - atomic masses : $\mathrm{H}=1, \mathrm{~N}=14, \mathrm{O}=16$ )
ii. Consider the reaction,
$3 \mathrm{I}_{(\mathrm{aq)}}^{-}+\mathrm{S}_{2} \mathrm{O}_{8}^{2-} \longrightarrow \mathrm{I}_{3(\mathrm{qq)}}^{-}+2 \mathrm{SO}_{4(\mathrm{qq)}}^{2-}$
At particular time $\mathrm{t}, \frac{\mathrm{d}\left[\mathrm{SO}_{4}^{2-}\right]}{\mathrm{dt}}=2.2 \times 10^{-2} \mathrm{M} / \mathrm{s}$.
What are the values of the following at the same time?
a. $-\frac{\mathrm{d}\left[\mathrm{I}^{-}\right]}{\mathrm{dt}}$
b. $-\frac{\mathrm{d}\left[\mathrm{S}_{2} \mathrm{O}_{8}^{2-}\right]}{\mathrm{dt}}$
c. $-\frac{\mathrm{d}\left[\mathrm{I}_{3}^{-}\right]}{\mathrm{dt}}$
iii. 300 M mol of perfect gas occupies 13 L at 320 K . Calculate the work done in joules when the gas expands -
a. isothermally against a constant external pressure of 0.20 atm .
b. isothermal and reversible process.
c. into vaccum until the volume of gas is increased by $3 \mathrm{~L} .\left(\mathrm{R}=8.314 \mathrm{~J} \mathrm{~mol}^{-1} \mathrm{~K}^{-1}\right)$
iv. What is the action of the following reagents on ammonia?
a. Excess of air
b. Excess of chlorine
c. Na metal

## Q. 4. Answer any ONE of the following:

i. a. Explain with reason sign conventions of $\Delta \mathrm{S}$ in the following reactions :

1. $\mathrm{N}_{2(\mathrm{~g})}+3 \mathrm{H}_{2(\mathrm{~g})} \longrightarrow 2 \mathrm{NH}_{3(\mathrm{~g})}$
2. $\mathrm{CO}_{2(\mathrm{~g})} \longrightarrow \mathrm{CO}_{2(\mathrm{~s})}$
b. Explain the following terms:
3. Smelting
4. Flux
c. Gold occurs as face centred cube and has a density of $19.30 \mathrm{~kg} \mathrm{dm}^{-3}$. Calculate atomic radius of gold. (Molar mass of $\mathrm{Au}=197$ )
ii. a. Explain the trends in the following properties with reference to group 16:
5. Atomic radii and ionic radii
6. Density
7. ionisation enthalpy
8. Electronegativity
b. In the electrolysis of $\mathrm{AgNO}_{3}$ solution 0.7 g of Ag is deposited after a certain period of time. Calculate the quantity of electricity required in coulomb.
(Molar mass of Ag is $107.9 \mathrm{~g} \mathrm{~mol}^{-1}$ ).
c. Define Osmosis.

## SECTION - II

Q.5. Select and write the most appropriate answer from the given alternatives for each sub-question:
i. In which of the following pairs, highest oxidation states of transition metals are found?
(A) nitriles and chlorides
(B) fluorides and chlorides
(C) fluorides and oxides
(D) nitriles and oxides
ii. Which of the following carbocations is least stable?
(A)

(B)

(C)

(D)

iii. Compound having general formula
 is called $\qquad$ .
(A) diester
(B) acid anhydride
(C) hemiacetal
(D) acetal
iv. The complex ion $\left[\mathrm{Co}\left(\mathrm{H}_{2} \mathrm{O}\right)_{5}(\mathrm{ONO})\right]^{2+}$ and $\left.\left[\mathrm{Co}\left(\mathrm{H}_{2} \mathrm{O}\right)_{5} \mathrm{NO}_{2}\right)\right]^{2+}$ are called $\qquad$ .
(A) linkage isomer
(B) ionisation isomer
(C) co-ordination isomer
(D) geometrical isomer
v. Inflammation of tongue is due to the deficiency of $\qquad$ .
(A) vitamin $\mathrm{B}_{1}$
(B) vitamin $\mathrm{B}_{2}$
(C) vitamin $\mathrm{B}_{5}$
(D) vitamin $\mathrm{B}_{6}$
vi. Identify the compound ' B ' in the following series of reaction:
propanenitrile $\xrightarrow{\mathrm{Na} / \text { alc }} \mathrm{A} \xrightarrow[\text { di. } \mathrm{HCl}]{\mathrm{NaNO}_{2}} \mathrm{~B}$.
(A) n-propyl chloride
(B) Propanamine
(C) n-propyl alcohol
(D) Isopropyl alcohol
vii. Which of the following reagents is best for the following conversion?


H
OH
(A) $\mathrm{LiAlH}_{4}$
(B) $\mathrm{H}_{3} \mathrm{O}^{+}$
(C) $\mathrm{H}_{2} / \mathrm{Ni}, 453 \mathrm{~K}$
(D) $\mathrm{Zn}-\mathrm{Hg}+\mathrm{HCl}_{\text {(con) }}$

## Q.6. Answer any SIX of the following :

i. Calculate magnetic moment of $\mathrm{Fe}_{(\mathrm{aq})}^{2+}$ ion $(\mathrm{Z}=26)$.
ii. How is ethanol prepared from methanal by using Grignard reagent?
iii. Write the chemical reaction to prepare novolac polymer.
iv. Why does p-nitrochlorobenzene undergo displacement reactions readily with attack of nucleophilic $\mathrm{HO}^{\ominus}$ ion?
v. What is the action of bromine in alkaline medium on
a. $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{NO}_{2}$
b.

vi. Define antioxidants and mention two examples.
vii. How is 4-methylpent-3-en-2-one obtained from propan-2-one?
viii. What are hormones? Write the structure of simple triglycerides.

## Q.7. Answer any THREE of the following:

i. Write the different oxidation states of manganese. Why +2 oxidation state of manganese is more stable?
ii. How are the following compounds prepared?
a. benzaldehyde from benzene
b. acetophenone from benzene
c. benzaldehyde from benzoyl chloride
iii. Define complex lipids and write the structures of nucleotide and nucleoside.
iv. Write the formulae of the following compounds:
a. Sodium hexanitrito - N - cobaltate (III)
b. Tetraaquodichlorochromium (III) chloride
c. Potassium tetracyanoaurate (III) ion

## Q.8. Answer any ONE of the following:

i. a. Explain the following terms:

1. Homopolymers
2. Elastomers
b. Explain the mechanism of cleansing action of soaps.
c. Write balanced chemical equations for the action of
3. phosphorus trichloride on propan-2-ol
4. hydrogen bromide on styrene in the presence of a peroxide
5. methyl bromide on silver propanoate
ii. a. Write a short note on Hoffmann bromamide degradation.
b. Explain the mechanism of action of hydroiodic acid on 3-methylbutan-2-ol.
c. Mention 'two' uses of propan-2-one.
