# 2017

## CHEMISTRY

( Major )

Paper : 6.4

**( Inorganic Chemistry )**

*Full Marks* : 60

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

**1.** Answer the following : 1×7=7

*(a)* For an atom with configuration $d^2$, write the possible values of $L$ and $S$.

*(b)* Identify the ground state term in

$^1P$ $^3P$ $^3F$ $^1G$

*(c)* Which two metals are responsible for stabilization of DNA?

*(d)* What is Wilson disease?

*(e)* Mention one example where an actinide element is used for the identification of a soluble metal ion.

*(f)* In which oxidation state Ac and Th are diamagnetic?

*(g)* How many α and β particles will be released when $^{238}_{92}U$ successively disintegrates to be transformed to $^{206}_{82}Pb$?

2. *(a)* Give explanation that $[CoCl_4]^{2-}$ is intense coloured compound whereas $[CoCl_6]^{3-}$ is faint in colour. 2

*(b)* Describe the use of gold compounds in medicine. 2

*(c)* Why classical smog has a reducing character but Los Angeles smog has an oxidizing character? 2

*Or*

What are hypercalcemia and hypocalcemia? What should be the blood calcium level?

*(d)* Calculate *Q*-value for the following nuclear reaction : 2

$$^{14}_{7}N + ^{4}_{2}He \rightarrow ^{16}_{8}O + ^{1}_{1}H + Q$$

Given, $M_N = 14{\cdot}0031$

$M_O = 16{\cdot}9991$

$M_{He} = 4{\cdot}0026$

$M_H = 1{\cdot}0078$

3. *(a)* Though three electronic transitions are expected only two are observed in the visible region of $[V(H_2O)_6]^{3+}$. Discuss the aspect with the help of Orgel diagram. 5

(b) What are the causes of carbon monoxide pollution in air? Why does concentration of carbon monoxide not increase to a significant extent in atmosphere? What is the main reason for high concentration of carbon monoxide in urban areas compared to countryside? 2+2+1=5

*Or*

How does cyanide ion act as a poison in the human body? What is the antidote to cyanide poisoning? 3+2=5

(c) Describe one method of separation of $^{235}U$ and $^{238}U$. 5

*Or*

Why is it difficult to separate lanthanide elements? Write briefly about oxidation states of lanthanides. 3+2=5

4. (a) The molar extinction coefficients for tetrahedral complexes are about $10^2$ times greater than those for octahedral complexes. Elaborate this statement. 5

(b) Explain the use of EDTA in complexometric determination of $Ca^{2+}$ and $Mg^{2+}$ ions from its mixture. 5

*Or*

*(c)* Define the terms 'labile' and 'inert' of the coordination compounds. Compare these aspects with stability of compounds with appropriate examples. 2+3=5

*(d)* Discuss the theory of colorimetric determination of metals. 5

**5.** *(a)* Write briefly about photosynthesis in the chloroplast membrane, clearly describing the role played by PS–I and PS–II. 5

*(b)* What is biological nitrogen fixation? Compare it with the Haber's process of synthesis of ammonia. 1+4=5

**6.** *(a)* A radioactive substance with initial concentration $N_0$ disintegrates with time $t$. How can you establish that the radioactivity of the substance will cease to exist only at infinite time? Show that change of radioactivity with time is a straight line with amplitude and intercept. 3+2=5

*(b)* Give a brief description of the chemistry of uranium. 5

*Or*

(c) (i) How would you account for stability of He nucleus? 2

(ii) What are radioactive tracers? Give one application of it with description. 1+2=3

(iii) What is the expected electronic configuration of gadolinium? It shows only one oxidation state of +3. Give reasons. 1+1=2

(iv) A remarkable characteristic of the spectra of the tripositive lanthanide and actinide ions is the sharpness of individual colour bands. Explain this observation. 3

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