B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

01130

Term-End Examination

December, 2010

ET-105(B) : CHEMISTRY

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt all questions. Use of calculator is allowed.*
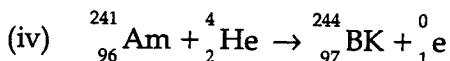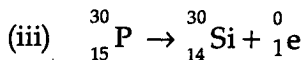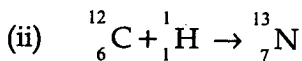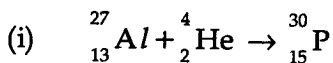
1.   Attempt **any two** of the followings :   2x5=10

(a)   Which of the following sets of quantum numbers is/are allowed ?

(i) $n=1$, $l=0$ and $m=0$

(ii) $n=2$, $l=1$ and $m=+1$

(iii) $n=1$, $l=0$ and $m=+1$

(iv) $n=2$, $l=2$ and $m=0$

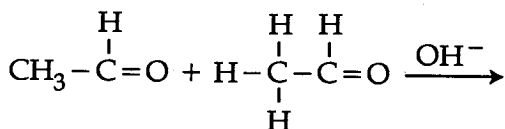(b)   Which of the following electronic energy in He^+ species is/are allowed ?

(i) $-13.6eV$

(ii) $-27.2eV$

(iii) $-54.4eV$

(iv) $-6.04eV$

(c) Nuclear reaction (s) accompanied by emission of neutron(s) is/are :

(i) $^{27}_{13}Al + ^{4}_{2}He \rightarrow ^{30}_{15}P$

(ii) $^{12}_{6}C + ^{1}_{1}H \rightarrow ^{13}_{7}N$

(iii) $^{30}_{15}P \rightarrow ^{30}_{14}Si + ^{0}_{1}e$

(iv) $^{241}_{96}Am + ^{4}_{2}He \rightarrow ^{244}_{97}BK + ^{0}_{1}e$

2. Attempt **any three** of the followings : 3x5=15

(a) Complete and name the following reaction :

$$CH_3 - \overset{\overset{\displaystyle H}{|}}{C} = O + H - \overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}} - \overset{\overset{\displaystyle H}{|}}{C} = O \xrightarrow{OH^-}$$

(b) The reaction A $\rightarrow$ products, follows first order kinetics. In 45 min, the concentration of A changes from 0.1M to 0.0125M. The rate of reaction when [A] = 0.001 M is :

(i) 2.31×10^{-5} mol L^{-1} min^{-1}

(ii) 4.62×10^{-5} mol L^{-1} min^{-1}

(iii) 2.31×10^{-4} mol L^{-1} min^{-1}

(iv) 4.62×10^{-4} mol L^{-1} min^{-1}

(c) Total number of lone pair of electrons in XeF_4 is :

(i) 0   (ii) 1

(iii) 2   (iv) 3

(d) The root mean square speed of gaseous molecules (molar mass : M) in terms of their molar kinetic energy (E) is :

(i) $U_{rms} = \sqrt{3E/2M}$

(ii) $U_{rms} = \sqrt{2E/3M}$

(iii) $U_{rms} = \sqrt{2E/M}$

(iv) $U_{rms} = \sqrt{E/3M}$

3. Attempt **any three** of the followings : 3x5=15
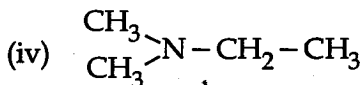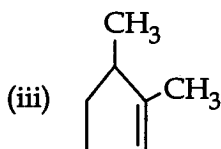
(a) How many monoatomic atoms is/are present in a simple cubic (SC), body centred cubic (BCC) and face centred cubic (FCC) unit cells ? What is the coordination number of each atom in SC, BCC and FCC in a unit cell ?

(b) What is the relation between atomic radius, 'r' and lattice parameter, 'a' in SC, BCC and FCC unit cell ?

(c) Define normality, molarity and molality. If normality of H_2SO_4 is 0.1N then what will be its molarity ?

(d) Iron is having BCC structure with atomic radius 124.7 pm. Calculate the edge length of the unit cell of BCC iron.

4. Attempt *any three* of the followings :   3x5=15

(a) What is miscells or associated colloids ? Explain cleaning action of soap.

(b) Give IUPAC names of the following :

(i) CH_2OH
      |
      CH_2OH

(ii) $CH_3 - CH - CHO$
              |
              CH_3

(iii)

(iv) $\underset{CH_3}{\overset{CH_3}{>}} N - CH_2 - CH_3$

(v) $CH_2 = C = CH_2$
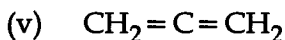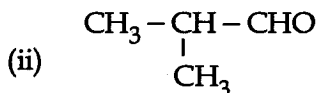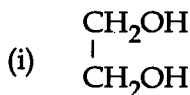
(c) Is O_2^- paramagnetic or diamagnetic ? Justify your answer. What is the bond order for O_2^- ?

(d) (i)   Two moles of an ideal gas undergoes isothermal reversible expansion from 2L to 8L at 300 K. What will be the enthalpy change of the gas ?

     (ii) Which orbit of the Be^{3+} has the same radius as that of the first Bohr's orbit of hydrogen atom ?

5. Attempt *any three* of the following : 3x5=15

Note : Each entry in column X in questions Part - A, B, C and D is some way related to the entries in column Y and Z. Match the appropriate entries. As an example : In question A, 'Orbital' in column X is related to 'Schrödinger equation' in column Y and it is also related to 'probability distribution' in column Z. So the answer will be

A : (f) – (b) – (a)

(A)

	X	Y	Z
(a)	Principal quantum no.	electrons	Probability distribution
(b)	Azimuthal quantum no.	Schrödinger	value : ½
(c)	Magnetic quantum no.	symbol : l	value : $-l$ to $+l$
(d)	Spin quantum no.	symbol : n	deflected towards anode
(e)	Cathod rays	symbol : m	values : 1,2,3....
(f)	Orbital	symbol : s	values: 0, 1 , 2 ... (n-1)

(B)

	X	Y	Z
(a)	sp hybridization	square planar	SO_2
(b)	sp^2 hybridization	tetrahedral	BeH_2
(c)	sp^3 hybridization	octahedron	$Cu(NH_3)_4^{2+}$
(d)	dsp^2 hybridization	triangular bipyramidal	ClO_3^-
(e)	d^2sp^3 hybridization	linear	PCl_5
(f)	dsp^3 hybridization	triangular planar	SF_6

(C)		X	Y	Z
	(a)	sp orbitals	33.3% S character	154 pm
	(b)	sp^2 orbitals	one σ and one π bond	134 pm
	(c)	sp^3 orbitals	one σ and two π bonds	bond angle 120°
	(d)	c$-$c bond	25% S character	121 pm
	(e)	c$=$c bond	one σ bond	bond angle 180°
	(f)	c$\equiv$c bond	50% S character	bond angle 109°28'

(D)		X	Y	Z
	(a)	CH_3CO group	aldehyde with no α-hydrogen	aldehydes
	(b)	Tollens reagent	carbonyl compound with α-hydrogen	mesitylene
	(c)	Fehling's solution	aldehydes	aldol
	(d)	Cannizzaro's reaction	conc. H_2SO_4	$CHCl_3$
	(e)	Aldol condensation	Cl_2 in NaOH	mixture of alcohol and acid
	(f)	Acetone	red - brown precipitate	silver mirror