



Previous Year Solved Question Paper
of

G.A.T.E. (XL) 2005

LIFE SCIENCES

XL: Chemistry

Examination

(Original Question Paper with Answer Key)

GRADUATE APTITUDE TEST IN ENGINEERING



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Section H: Chemistry (Compulsory)

[Useful data: $F = 96485 \text{ C mol}^{-1}$; $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$; Atomic number: Co, 27.]

Q.1 – Q.10 carry one mark each.

Q.1 Elements exhibiting +2 oxidation state in their compounds is:

- (A) Zn and P (B) Ca and Al (C) Al and P (D) Zn and Ca


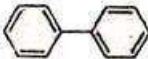


Q.2 The paramagnetic species is:

- (A) Na_2 (B) NO^+ (C) CN (D) CO

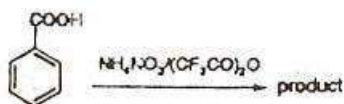
Q.3 Hydride that readily liberates hydrogen gas on reaction with water is:

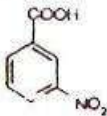
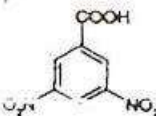
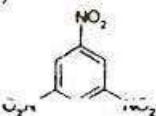
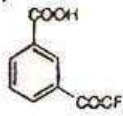
- (A) NaBH_4 (B) CaH_2 (C) SiH_4 (D) NH_3

Q.4 Which one of the following is aromatic?

- (A)  (B)  (C)  (D) 

Q.5 Identify the product of the following reaction.



- (A)  (B)  (C)  (D) 

Q.6 Which one of the following is most acidic?

- (A) Butanoic acid (B) 3-Chlorobutanoic acid
(C) 2-Chlorobutanoic acid (D) 4-Chlorobutanoic acid

Q.7 Total number of stereoisomers possible in $\text{CH}_3\text{-CH(Ph)-CH=CHCH}_3$ is:

- (A) 1 (B) 2 (C) 3 (D) 4

Q.8 The standard EMF of the cell, set up from the reaction $2\text{Cu}^+(\text{aq}) \rightarrow \text{Cu}(s) + \text{Cu}^{2+}(\text{aq})$ is 0.36 V at 298 K. The standard Gibbs free energy in kJ/mol for this reaction is:

- (A) -34.73 (B) -69.46 (C) -3473 (D) -6946

Q.9 Heisenberg's uncertainty principle is expressed as:

- (A) $\Delta p \Delta x \geq h/2\pi$ (B) $\Delta p \Delta x \leq h/4\pi$
(C) $\Delta p \Delta x \leq h/2\pi$ (D) $\Delta p \Delta x \geq h/4\pi$

Q.10 For the reaction, $\text{C}_2\text{H}_2(\text{O}_2)(s) + 6\text{O}_2(g) \rightarrow 6\text{CO}_2(g) + 6\text{H}_2\text{O}(l)$, $\Delta U = -2810$ kJ/mol. ΔH in kJ/mol is:

- (A) 845 (B) -890 (C) -2810 (D) -2864

Q.11 – Q.26 carry two marks each.

Q.11 Which one of the following is a repeating unit of silicone?

- (A) $\text{Si}(\text{CH}_3)_4$ (B) $\text{Si}(\text{CH}_3)_2\text{O}$
(C) SiO_2 (D) $\text{Si}(\text{OCH}_3)_4$

Q.12 The order of lattice energy of NaX is $\text{NaI} < \text{NaBr} < \text{NaCl} < \text{NaF}$. The property of X/X⁻, responsible for the trend is:

- (A) ionic radii (B) electronegativity
(C) atomic radii (D) electron affinity

Q.13 Among BF_3 , CF_4 , PF_5 , and OF_2 , the molecules that are expected to have a zero dipole moment is:

- (A) OF_2 and CF_4 (B) BF_3 and PF_5
(C) OF_2 and PF_5 (D) BF_3 and CF_4

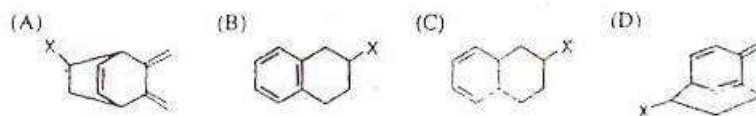
Q.14 Air oxidation of sodium metal produces a hygroscopic compound 'X', which reacts with CO_2 to produce 'Y'. X and Y respectively are:

- (A) Na_2O and Na_2CO_3 (B) Na_2O and NaHCO_3
(C) NaOH and Na_2CO_3 (D) Na_2O and Na_2CO_3

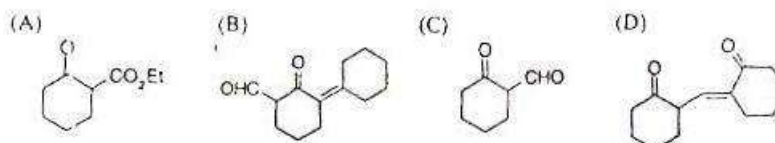
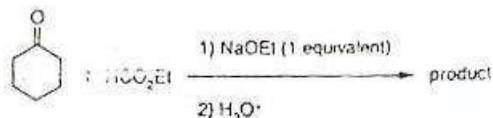
Q.15 The product of reaction of HNO_3 with P_4 and P_4O_{10} respectively are:

- (A) N_2O_5 and N_2O_5 (B) N_2O_5 and NO_2
(C) NO_2 and N_2O_5 (D) NO and NO_2

Q.16 Identify the product for the following Diels-Alder reaction.



Q.17 Major product of reaction given below is:



Q.18 0.050 mol of Ar initially at 25 °C, expands adiabatically and reversibly from 0.50 L to 1.00 L ($C_{v,m}$ for Ar is 12.48 J/Kmol). The work done in this process is:

- (A) 117 J (B) -69 J (C) -138 J (D) -1378 J

Q.19 Efficiency of a reversible cyclic heat engine working between T_c and T_h is:

- (A) $-T_c/T_h$ (B) $(T_c - T_h)/T_h$
(C) $(T_h - T_c)/T_h$ (D) T_c/T_h

Q.20 To prepare one liter of an acetate buffer of 0.1 ionic strength and pH 5, at 25 °C, the moles of sodium acetate and acetic acid (dissociation constant = 2.69×10^{-5}) to be added respectively are:

- (A) 0.1 and 0.0372
(B) 0.0372 and 0.1
(C) 0.01 and 0.372
(D) 0.372 and 0.01

Q.21 The EMF of the cell $\{\text{Pt}, \text{H}_2(1 \text{ atm})\} \parallel \text{HCl}(\text{aq}) \parallel \text{AgCl}, \text{Ag}$ is 0.332 V and the EMF of $\text{AgCl} \parallel \text{Ag}$ electrode is 0.277 V. pH of the solution is:

- (A) 0.926 (B) 1.03 (C) 3.26 (D) 5.61

- Q.22 In a saturated aqueous solution of CaF_2 , the concentrations of Ca^{2+} and F^- are $3.3 \times 10^{-4} \text{ M}$ and $6.7 \times 10^{-4} \text{ M}$, respectively. On adding NaF to this solution, if the concentration of Ca^{2+} changes to $1.5 \times 10^{-4} \text{ M}$, then molar concentration of F^- will be:
- (A) 1.0×10^{-6} (B) 1.0×10^{-6} (C) 1.0×10^{-4} (D) 1.0×10^{-3}

Common Data Questions

Common data for Q.23 & Q.24: Reaction: $\text{A} + \text{B} \rightarrow \text{products}$

- Q.23 When the reaction is first order in A and zero order in B, rate constant is:

- (A) $[-1/t] \ln \left(\frac{[A]_t}{[A]_0} \right)$ (B) $(-1/t) \ln \left(\frac{[A]_t}{[A]_0} \right)$
 (C) $(1/t) \ln \left(\frac{[A]_t}{[A]_0} \right)$ (D) $\{1/t([A]_0)\} \ln \left(\frac{[A]_t}{[A]_0} \right)$

- Q.24 When the reaction is second order in A and zero order in B, rate constant is:

- (A) $(1/t) \left\{ \frac{1}{([A]_t) - [A]_0} \right\} \ln \left(\frac{[A]_0}{[A]_t} \right)$
 (B) $(1/t) \left\{ \frac{1}{([A]_t) - [A]_0} \right\}$
 (C) $\{1/t([A]_0)\} \left\{ \frac{1}{([A]_t) - [A]_0} \right\} \ln \left(\frac{[A]_0}{[A]_t} \right)$
 (D) $\{1/t([A]_0)\} \left\{ \frac{1}{([A]_t) - [A]_0} \right\}$

Common data for Q.25 & Q.26: 3,3-dimethyl-1-butene ($\text{Me}_3\text{C}-\text{CH}=\text{CH}_2$), on reaction with

- Q.25 hydrochloric acid produces a halogenated compound as major product. The product is:

- (A) $\text{Me}_3\text{C}-\text{CH}(\text{Cl})-\text{CH}_3$ (B) $\text{Me}_3\text{C}-\text{CH}_2-\text{CH}_2\text{Cl}$
 (C) $\text{Me}_2\text{C}(\text{Cl})-\text{CHMe}_2$ (D) $\text{Me}_2\text{C}(\text{Cl})-\text{CH}_2\text{CH}_2\text{CH}_3$

- Q.26 $\text{Hg}(\text{OCOCH}_3)_2$ followed by treatment with alkaline NaBH_4 produces:

- (A) $\text{Me}_2\text{C}(\text{OH})-\text{CHMe}_2$ (B) $\text{Me}_2\text{C}(\text{OH})-\text{CH}_2\text{CH}_2\text{CH}_3$
 (C) $\text{Me}_3\text{C}-\text{CH}_2-\text{CH}_2\text{OH}$ (D) $\text{Me}_3\text{C}-\text{CH}(\text{OH})-\text{CH}_3$

Linked Answer Questions: Q.27a to Q.28b carry two marks each.

Statement for linked answer question Q.27a & Q.27b: A pink coloured aqueous solution of CoCl_2 changes immediately to blue, on adding excess of Cl^- ion.

- Q.27a The blue coloured species is:

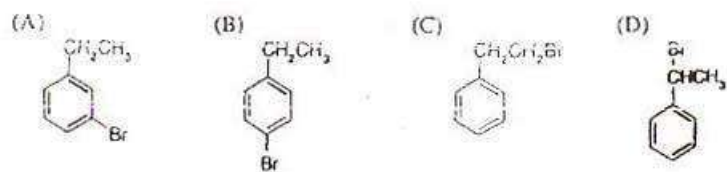
- (A) $[\text{CoCl}_6]^{3-}$ (B) $[\text{CoCl}_4]^{2-}$
 (C) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ (D) $[\text{CoCl}_4]^{1-}$

- Q.27b The d-electron configuration for the blue complex ion is:

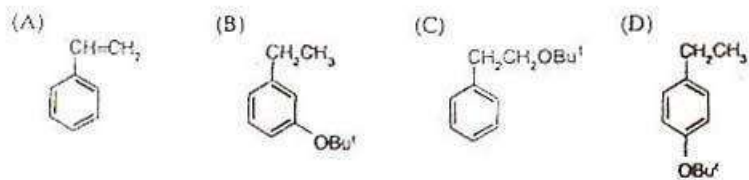
- (A) $e^3 t_2^3$ (B) $t_2^3 e_g^2$ (C) $t_2^4 e_g^2$ (D) $e^4 t_2^3$

Statement for linked answer question Q.28a & Q.28b: Ethylbenzene reacts with

Q.28a N-bromosuccinimide to produce a compound 'X'. X is:



Q.28b 'X' on treatment with *t*-BuOK in butanol provides 'Y'. The product Y is:



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