Previous Year Solved Question Paper

of

G.A.T.E. (XL) 2009

LIFE SCIENCES

XL: Chemistry

Examination

(Original Question Paper with Answer Key)

GRADUATE APTITUDE TEST IN ENGINEERING

XL : LIFE SCIENCES

Duration : Three Hours *Maximum Marks* : 100

Read the following instructions carefully.

1. This question paper contains **32** printed pages including pages for rough work. Please check all pages and report discrepancy, if any.

2. Write your registration number, your name and name of the examination centre at the specified locations on the right half of the Optical Response Sheet (**ORS**).

3. Using HB pencil, darken the appropriate bubble under each digit of your registration number and the letters corresponding to your paper code.

4. All the questions in this question paper are of objective type.

5. Questions must be answered on **O**ptical **R**esponse Sheet (**ORS**) by darkening the appropriate bubble (marked A, B, C, D) using HB pencil against the question number on the left hand side of the ORS. **Each question has only one correct answer**. In case you wish to change an answer, erase the old answer completely. More than one answer bubbled against a question will be taken as an incorrect response.

6. This question paper contains **six** sections as listed below. Section H (Chemistry) is compulsory section. Choose **two** more sections from the remaining.

Section	Page No.	Section	Page No.
H. Chemistry	02	K. Botany	13
I. Biochemistry	06	L. Microbiology	18
J. Biotechnology	09	M. Zoology	21

Using HB pencil, mark the sections you have chosen by darkening the appropriate bubbles on the left hand side of the **ORS** provided. **Make sure you have correctly bubbled the sections you have chosen. ORS will not be evaluated if this information is NOT marked.**

7. There are 18 questions carrying 30 marks in Chemistry section paper (section H), which is compulsory. Questions 1 through 6 are 1-mark questions, questions 7 through 18 are 2-mark questions, Questions 15 and 16 (1 pair) are common data questions with 2-marks each and questions 17 and 18 (1 pair) are linked answer questions with 2-marks each. In the remaining sections, each section will contain 21 questions of total 35 marks. Questions 1 through 7 are 1-mark questions. Questions 8 through 21 are 2-mark questions.

8. Un-attempted questions will carry zero marks.

9. Wrong answers will carry NEGATIVE marks. In section H, for Q. 1 to Q.6, ⅓ mark will be deducted for wrong answer. For Q. 7 to Q. 16, ⅔ mark will be deducted for wrong answer. The question pair (Q. 17 and Q. 18) is questions with linked answers. There will be negative marks only for wrong answer to the first question of the linked answer question pair, i.e. for Q.17, ⅔ mark will be deducted for wrong answer. There is no negative marking for Q.18. In all other sections (sections I through M), for Q.1 to Q.7, ⅓ mark will be deducted for each wrong answer and for Q.8 to Q.21, ⅔ mark will be deducted for each wrong answer.

10. Calculator (without data connectivity) is allowed in the examination hall.

11. Charts, graph sheets or tables are NOT allowed in the examination hall.

12. Rough work can be done on the question paper itself. Additionally, blank pages are given at the end of the question paper for rough work.

H : CHEMISTRY (*Compulsory*)

Useful data for Section H: Chemistry

R = 0.08315 L bar $K^{-1}mol^{-1}$; F = 96490 C mol^{-1}; Atomic Numbers: Fe,26; Co,27

Q. 1 – Q. 6 carry one mark each.

Q.1 For a second order reaction, $R \xrightarrow{k} P$, the relation between half-life time ($t_{1/2}$) and the initial reactant concentration $[R]_0$ is

(A) $t_{1/2} = \frac{\ln 2}{k}$ (B) $t_{1/2} = \frac{2}{k[R]_0}$

(C) $t_{1/2} = \frac{1}{k[R]_0^2}$ (D) $t_{1/2} = \frac{1}{k[R]_0}$

Q.2 The reversible and irreversible entropy changes of a system on going from state '1' to state '2' are ΔS_{12}^{rev} and ΔS_{12}^{irrev} respectively. The correct relationship between the two entropy changes is

(A) $\Delta S_{12}^{irrev} > \Delta S_{12}^{rev}$ (B) $\Delta S_{12}^{irrev} < \Delta S_{12}^{rev}$

(C) $\Delta S_{12}^{irrev} = \Delta S_{12}^{rev}$ (D) $\Delta S_{12}^{irrev} = -\Delta S_{12}^{rev}$

Q.3 Among the following molecules the one that is planar is

(A) $(CH_3)_3N$ (B) $[SO_4]^{2-}$

(C) $[CO_3]^{2-}$ (D) PCl_3

Q.4 Among the following molecules the one that exhibits **only** one isomer is

(A) $[Fe(H_2O)_5OH]^{2+}$ (B) $Pt(NH_3)_2Cl_2$

(C) $[Pt(NH_3)_3Cl_3]^+$ (D) $[CoCl_3(NH_3)_3]$

Q.5 The most stable carbocation among the following is

(A) $CH_3OCH_2CH_2^+$

(B) $CH_3CH{=}CHCH_2^+$

(C) $CH_3CH_2^+$

(D) 

Q.6 The carboxylic acid with the lowest pK_a value is

(A) $C_6H_5CO_2H$ (B) CH_3CO_2H

(C) p-CH_3O-$C_6H_4CO_2H$ (D) p-CH_3-$C_6H_4CO_2H$

Q. 7 to Q.18 carry two marks each.

Q.7 If the ground state ionization energy of the hydrogen atom is denoted by ε, then the energy required to ionize an electron from the 3d energy level of the hydrogen atom is

(A) $\frac{2\varepsilon}{3}$ (B) $\frac{\varepsilon}{9}$

(C) $\frac{\varepsilon}{3}$ (D) $\frac{8\varepsilon}{9}$

Q.8 Given the following standard electrode potentials at 25 °C:

$$\frac{1}{2}\,Fe^{2+} + e^- = \frac{1}{2}\,Fe(s) \; ; \; E^0 = -0.440\,V$$

$$Fe^{3+} + e^- = Fe^{2+} \; ; \; E^0 = +0.771\,V$$

The standard electrode potential at 25 °C for

$$Fe^{3+} + 3e^- = Fe(s)$$

is

(A) $-0.036\,V$ (B) $-0.331\,V$

(C) $-0.662\,V$ (D) $-2.422\,V$

Q.9 Identify the major product **Q** formed in the following reaction :

$$(CH_3)_2CHCH_2Br \xrightarrow[EtOH]{NaOEt} Q$$

(A) $CH_3CH(OEt)CH_2CH_3$ (B) $(CH_3)_2CHCH_2OEt$

(C) $(CH_3)_3COEt$ (D) $(CH_3)_2C{=}CH_2$

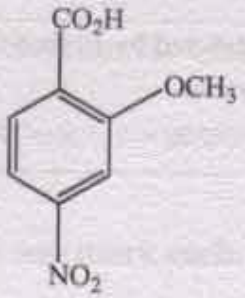
Q.10 The reaction of $AgNO_3$ with KCl in an aqueous environment leads to an insoluble product **P**. Treatment of **P** with an excess of KCl leads to its dissolution because of the formation of **Q**.

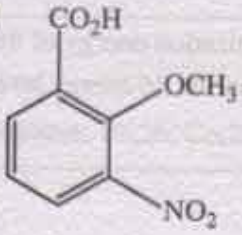
P and **Q** respectively are

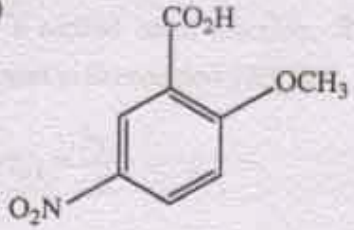
(A) AgCl and $[AgCl_2]^-$ (B) $[AgCl_2]^-$ and AgCl

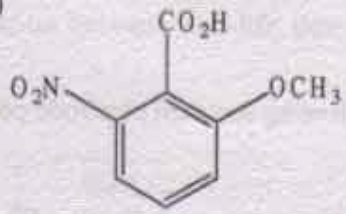
(C) AgCl and $[AgCl_3]^-$ (D) $[AgCl_2]^-$ and $[AgCl_3]^{2-}$

Q.11 The major product formed in the nitration of *o*-methoxybenzoic acid is

(A) 

(B) 

(C) 

(D) 

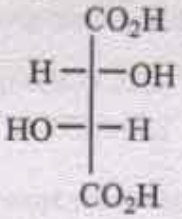
Q.12 Match the following :

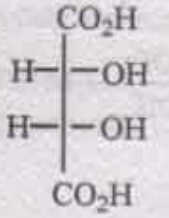
P. $[CoCl_4]^{2-}$
Q. $[Fe(H_2O)_6]^{3+}$
R. $[Fe(CN)_6]^{4-}$

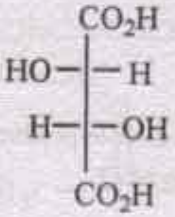
1. $\sqrt{15}BM$
2. $0BM$
3. $\sqrt{35}BM$

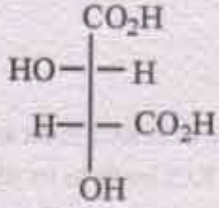
(A) P-2, Q-3, R-1
(B) P-2, Q-1, R-3
(C) P-1, Q-3, R-2
(D) P-3, Q-2, R-1

Q.13 Which one of the following Fischer projections represents (*S,S*)-tartaric acid ?

(A) 

(B) 

(C) 

(D) 

Q.14 Which one among the following compounds loses a proton most readily in a basic medium ?

(A) Cyclopentadiene
(B) Cycloheptatriene
(C) Cyclopropene
(D) 1,3-Cyclohexadiene

Common Data Questions

Common Data for Questions 15 and 16:

For the reaction, P(g) = 2Q (g), the equilibrium constant with a standard state pressure of 1 bar is 0.25. Assume ideal gas behaviour.

Q.15 The total pressure (in bar) needed for 50% conversion of **P** into **Q** is

(A) 0.1250 (B) 0.1875

(C) 0.5000 (D) 0.7500

Q.16 The amount of **P** that will be converted to **Q** at a total pressure of 0.5 bar is approximately

(A) 13% (B) 25%

(C) 33% (D) 55%

Linked Answer Questions

Statement for Linked Answer Questions 17 and 18:

The reaction of BF_3 with $NaBH_4$ leads to the formation of a stable gaseous boron compound **P**. The compound **P** reacts with Me_3N to give **Q**.

Q.17 Identify **P** among the following :

(A) BH_3 (B) $Na[B_3H_8]$

(C) B_2H_6 (D) B_4H_{10}

Q.18 The compound **Q** is

(A) $BH_3 \cdot NMe_3$ (B) $B_2H_5 \cdot NMe_3$

(C) $B_4H_9 \cdot NMe_3$ (D) $BH_3 \cdot 2NMe_3$

END OF SECTION - H

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