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AskIITians IIT JEE Chemistry Test

Code – AC213

Time - One hour

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

A. General :

1. This booklet is your Question paper containing 69 questions.
2. Blank papers, clipboard, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. The answer sheet, a machine-readable Objective Response Sheet (ORS), is provided separately.

B. Filling the ORS :

4. On the lower part of the ORS, write in ink, your name, your Registration No. Do not write these anywhere else.
5. Make sure the CODE on the ORS is the same as that on this booklet and put your signature on the ORS affirming that you have verified.
6. Write your Registration No. in ink, provided in the lower part of the ORS and darken the appropriate bubble UNDER each digit of your Registration No. with a good quality HB pencil.

C. Question paper format.

7. The question paper consists of 3 parts (Physics, Chemistry and Mathematics). Each part has 4 sections.
8. Section I contains 6 multiple choice question. Each question has four choices (A), (B), (C) and (D), out of which only one is correct.
9. Section II contains 4 questions. Each question has four choices (A), (B), (C) and (D), out of which one or more choices is correct.
10. Section III contains 4 questions. Each question contains Statement -1 (Assertion) and Statement -2 (Reason).
    Bubble (A) if both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1.
    Bubble (B) if both the statements are TRUE butSTATEMENT-2 is NOT the correct explanation of STATEMENT-2.
    Bubble (C) if STATEMENT-1 is TRUE and STATEMENT-2 is FALSE.
    Bubble (D) if STATEMENT-1 is FALSE and STATEMENT-2 is TRUE.
11. Section IV contains 3 paragraphs. Based upon each paragraph, three multiple choice questions have to be answered. Each question has four choices (A) (B) (C) (D) out of which only one is correct.

D. Marking Scheme.

12. For each question in Section I, you will be awarded 3 marks if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (–1) mark will be awarded.
13. For each question in Section II, you will be awarded 4 marks, if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, (–1) mark will be awarded.
14. For each question in Section III, you will be awarded 3 marks, if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, (–1) mark will be awarded.
15. For each question in Section IV, you will be awarded 3 marks, if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, (–1) will be awarded.

Useful Data

Gas Constant	R	= 8.314 J K^{-1} mol^{-1}	**1 Faraday**	=	96500 Coulomb
		= 0.0821 Lit atm K^{-1} mol^{-1}	**1 calorie**	=	4.2 Joule
		= 1.987 ≈ 2 Cal K^{-1} mol^{-1}	**1 Ev**	=	1.6 × 10^{-1} J
Avogadro's Number	Na	= 6.023 × 1023			
Planck's constant	h	= 6.625 × 10^{-34} J . s			

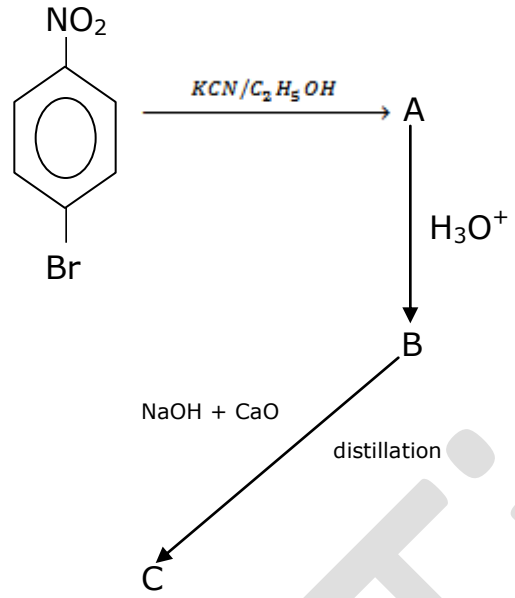
$= 6.625 \times 10^{-27}$ erg . s

Atomic No: H = 1, D = 1, Li = 3, Na = 11, K = 19, Rb = 37, Cs = 55, F = 9, Ca = 20, He = 20, He = 2, O = 8, Au = 79, Ni = 28, Zn = 30, Cu = 29, Cl = 17, Br = 35, Cr = 24, Mn = 25, Fe = 26, S = 16, P = 15, C = 6, N = 7, Ag = 47.

Atomic Masses: He = 4, Mg = 24, C = 12, O = 16, N = 14, P = 31, Br = 80, Cu = 63.5, Fe = 56, Mn = 55, Pb = 207, Au = 197, Ag = 108, F = 19, H = 1, Cl = 35.5, Sn = 118.6, Na = 23, D = 2, Cr = 52, K = 39, Ca = 40, Li = 7, Be = 4, Al = 27, S = 32.

SECTION – I

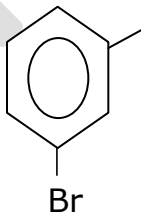
1.



Product C is

(a)

(b)



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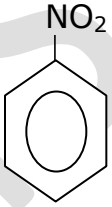
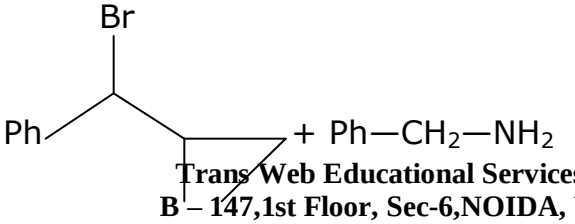
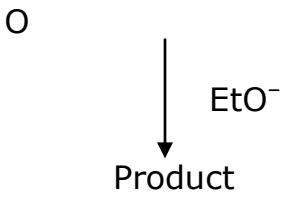


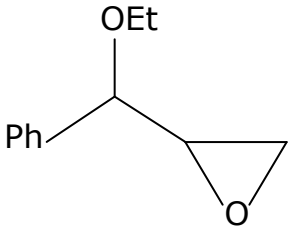
(d) none of these

2.

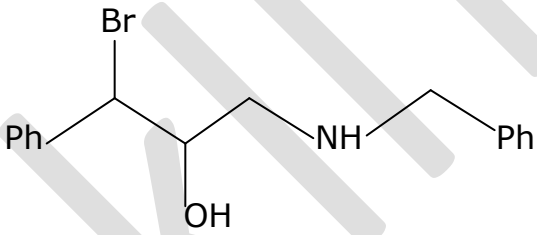


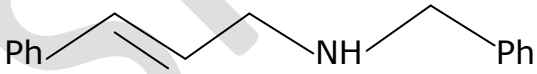


Product is

(a) 

(b) 

(c) 

(d) 

3. There is no S—S bond in
   (a) $S_2O_3^{2-}$
   (b) $S_2O_4^{2-}$
   (c) $S_2O_5^{2-}$
   (d) $S_2O_7^{2-}$

4. Which pairs gives Cl_2 gas at room temperature?
   (a) Conc. HCl + $KMnO_4$
   (b) NaCl + Conc. H_2SO_4

(c) $NaCl + MnO_2$
(d) $NaCl$ + Conc. HNO_3

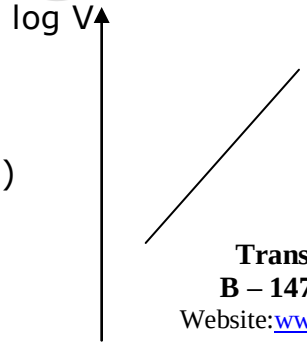
5. The magnitudes of enthalpy changes for irreversible adiabatic expansion of a gas from 1L to 2L is ΔH_1 and for reversible adiabatic expansion for the same expansion is ΔH_2. Then
(a) $\Delta H_1 > \Delta H_2$
(b) $\Delta H_1 < \Delta H_2$
(c) $\Delta H_1 = \Delta H_2$, enthalpy being a state function
(d) $\Delta H_1 = \Delta E_1$ and $\Delta H_2 = \Delta E_2$ where ΔE_1 and ΔE_2 are magnitudes of change in internal energy of gas in these expansions respectively.

6. The activation energies of two reactions are E_a and E_a' with Ea > E_a'. If temperature of the reacting systems is increased from T_1 to T_2, predict which of the following alternative is correct?
(a) $\frac{k_1'}{k_1} = \frac{k_2'}{k_2}$
(b) $\frac{k_1'}{k_1} > \frac{k_2'}{k_2}$
(c) $\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$
(d) $\frac{k_1'}{k_1} < \frac{2k_2'}{k_2}$

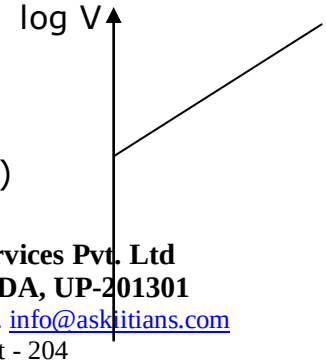
7. Which of the following statement are not correct?
(a) a meso compound has chiral centres but exhibits no optical activity
(b) a racemic mixture is optically inactive because of two equal and opposite rotation of same molecules in mixture.
(c) a meso compound has molecules which are superimpossible on their mirro images even though they contain chiral centres.
(d) a meso compound is optically inactive because the rotation caused by any molecule is cancelled by an equal and opposite rotation by another molecule that is mirror image of the first.

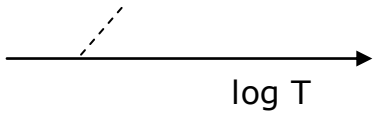
8. Which of the following sketches is an isobar $\left(\frac{nR}{p} > 1\right)$

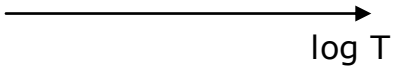
(a)



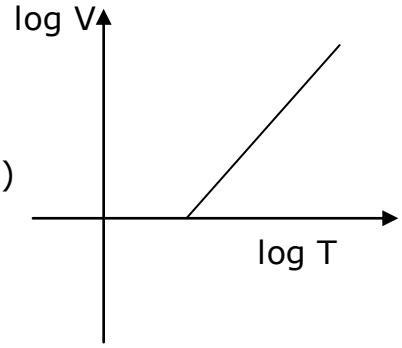
(b)



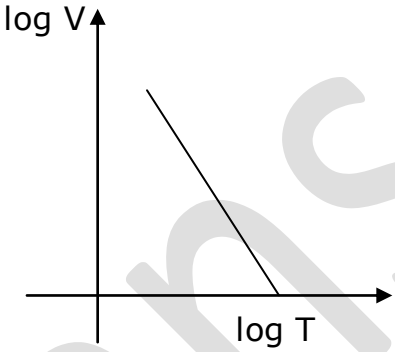




(c)



(d)



9. The chemical composition of "slag" formed during the smelting process in the extraction of copper is
   (a) $Cu_2O + FeS$
   (b) $FeSiO_3$
   (c) $CuFeS_2$
   (d) $Cu_2S + FeO$

SECTION – II

1. Statement 1: An important feature of Fluorite structures is that cations being large in size occupy FCC lattice points whereas anions occupy all the tetrahedral voids giving the formula unit, AB_2 (A:cation; B:anion).
   Statement 2: There are 6 cations and 12 anions per FCC unit cell of the fluorite structure.

2. Statement 1: 0.20M solution of NaCN is more basic than 0.20M solution of NaF.
   Statement 2: 0.20M solution of NaCN is more basic than 0.20M solution of CH_3COONa.

3. Statement 1: Alkanes float on the surface of water.
   Statement 2: Density of alkanes is in range of 0.6– 0.9 g/ml which is lower than water.

4. Statement 1: All the complexes of Pt(+2) and Au(+3) with strong field as well as with weak field ligands are square planar.
   Statement 2: The crystal field splitting energy is larger for second and third row transition elements, and for more highly charged species.

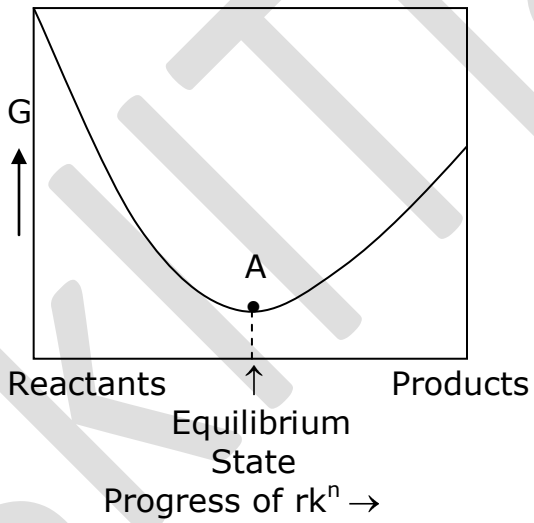
This larger value of crystal field splitting energy inergetically favours the pairing of electron for square planar geometry.

SECTION – III

Paragraph

For a reversible reaction at constant temperature and at constant pressure the equilibrium composition of reaction mixture corresponds to the lowest point of Gibbs energy vs. progress of reaction diagrams as shown.

At equilibrium Gibbs energy of reaction is equal to zero.



1. The value of $\log_{10}{}^{k}eq$ is equal to [k_{eq} is the equilibrium constant]

(a) $-\frac{\Delta G^o}{RT}$

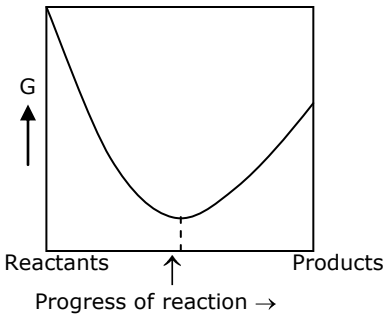
(b) $-\frac{T\Delta S^o - \Delta H^o}{2.303RT}$

(a) $\frac{\Delta H^o - T\Delta S^o}{RT}$

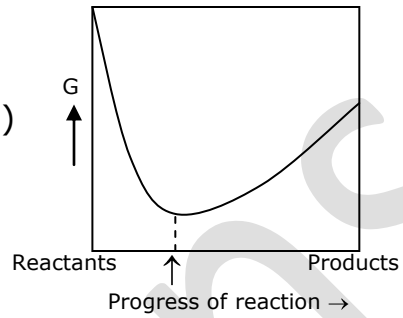
(b) $\frac{RT}{T\Delta S^o - \Delta H^o}$

2. Which diagram represents the large value of equilibrium constant for the reversible reaction.

(a)



(b)



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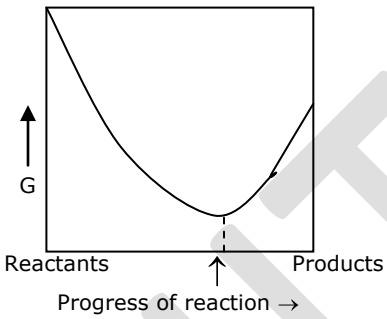
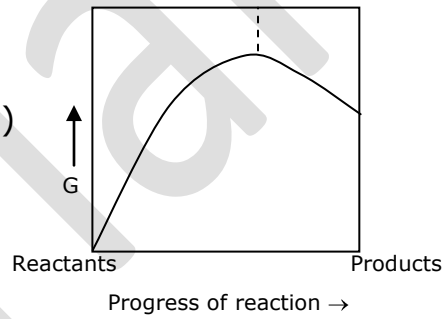


(d)



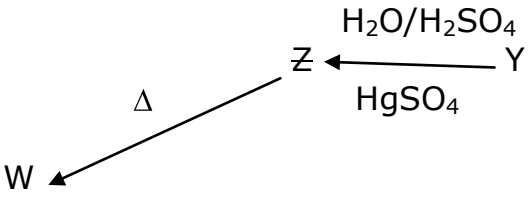
3. For a reaction, $M_2O_{(s)} \rightarrow 2M_{(s)} + \frac{1}{2} O_{2(g)}$ ΔH = 30kJ/mol and ΔS = 0.07 kJ/mol at 1 atm. The reaction would not be spontaneous at temperatures
   (a) > 428K
   (b) < 428K
   (c) < 100K
   (d) > 100K

Paragraph

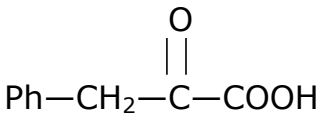
Observe the following sequence of reaction and answer the questions based on it.

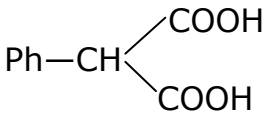
Phenylacetylene $\xrightarrow[-CH_4]{CH_3MgBR}$ X

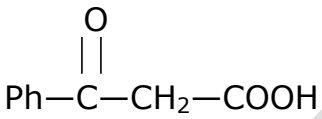
(i) CO_2
(ii) $H^{\oplus}$



1. Compound Z is

(a) 

(b) 

(c) 

(d) $Ph—CH_2—COOH$

2. Which of the following statement is not correct?
   (a) Y decolourises Br_2/H_2O solution
   (b) on heating Z, CO_2 is liberated
   (c) W on reaction with NaOI gives yellow precipitate.
   (d) X liberates H_2 gas with Na metal.

3. Which of the following gives benzoic acid upon oxidation with $KMnO_4$?
   (a) W
   (b) Y
   (c) Z
   (d) all

SECTION – IV

1. Match the reactants in Column I with nature of the reactions/type of the products in Column II

Column I		Column II	
(a)	$MnO_4^{2-} + H^+ \rightarrow$	(p)	One of the products of transition element is paramagnetic.
(b)	$Cu^+_{(aq.)} \rightarrow$	(q)	Disproportionation reaction

(c)	$Cr_2O_{7(s)}^{2-} + H^+$ (conc.) + $Cl_{(s)}^- \rightarrow$	(r)	One of the product is liberated as coloured vapours.
(d)	$Fe_2(SO_4)_3 + 3I^- \rightarrow$	(s)	In one of the products central atom exhibits its highest oxidation state.

2.

Column I		Column II	
(a)	Concentration Cell	(p)	$H_2 + \frac{1}{2} O_2$ ↓ H_2O + electrical energy
(b)	Spontaneous Cell reaction	(q)	$E^o_{Cell} = 0$
(c)	Daniel Cell	(r)	$E_{cell} > 0$
(d)	Hofmann Voltmeter	(s)	Galvanic Cell
(e)	Fuel Cell	(t)	H_2O + electrical energy ↓ $H_2 + \frac{1}{2} O_2$

3. Match the reactions listed in Column I with the colour of the precipitate listed in Column II.

Column I		Column II	
(a)	$Cu_{(aq)}^{2+} + 2SCN^-_{(aq.)}$ ↓ H^+ allowed to stand for sometime	(p)	Brown
(b)	Hot $Bi_{(aq.)}^{3+} + C_6H_3(OH_3)$ ↓	(q)	Brownish red
(c)	$Ag^+_{(aq.)} + AsO_{4(aq.)}^{3-}$ ↓	(r)	Yellow
(d)	$Mn^{2+}(aq.) + 2OH^-_{(aq.)} \xrightarrow{air}$	(s)	White